



# Nature's Classroom and the Next Generation Science Standards



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Nature's Classroom

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## Introduction:

**This document is an outline of the Nature's Classroom (NC) Science Curriculum and the Next Generation Science Standards (NGSS). The NC classes are organized by the standards each class meets in grades three through middle school. The standards are categorized by targeted standards and secondary/supporting standards. If a class is listed under a targeted standard, then the class has been found to specifically address all elements of the particular standard. A secondary/ supporting standard class means that the class may touch on the standard as part of the class, or include elements of the standard or information that directly supports the standard, but not all parts of the standard are specifically addressed in the class. A secondary standard class may also serve as an introduction to a topic. Many classes appear under more than one standard and grade. Our curriculum encompasses a wide variety of science content and can be adapted for a variety of ages, thus many classes address standards in more than one science subject and grade level.**

~Denotes Possible Large Group Class or Evening Activity

## Third Grade:

### 3-PS2 Motion and Stability: Forces and Interactions

#### 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.** [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]

**Targeted Standard:** *Avalanche, Bernoulli and the Magical Puffer, Blast Off, Boomerangs, Bounce, Bounce With Me, Going with the Flow, Hack It Up, Have a Ball, How to Cross a Desert, Just Plane Fun, Making Sense Out of Physics, Mile-a-Minute Murphy, The Old Mill Stream, Plumping Mill, This Class Will Blow You Away, Trebuchets and Catapults, Ultimate, Ups and Downs, Wind Energy*

**Secondary/Supporting Standard:** *Batmobiles, Get a Half Life, Go Fly a Kite, Juggle, ~Science Fair*

#### 3-PS2-2.

**Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.** [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]

**Targeted Standard:** *Have a Ball, Juggle, Pendulum Principles*

**Secondary/Supporting Standard:** *All Geared up, Bad Spin, Get a Half Life, Glow Power, Going with the Flow, Mile-a-Minute Murphy*

#### 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.** [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paper clips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]

**Targeted Standard:** *Electrifying, Electric Motor, Electronics, Electroplating, Field of Dreams, Magnetic Field Detectors, Magnetism, Making Electricity, Liquid Love and Attraction*

**Secondary/Supporting Standard:** *Asteroids, Compass and Design, ~Night Experience, Piezo Power*

#### 3-PS2-4.

**Define a simple design problem that can be solved by applying scientific ideas about magnets.** [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

**Targeted Standard:** *Field of Dreams, Magnetic Field Detectors, Magnetism, That's Shocking*

**Secondary/Supporting Standard:** *Liquid Love and Attraction*

**3-LS1 From Molecules to Organisms: Structures and Processes**

**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.** [Clarifying Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]

**Targeted Standard: *Ant Farm, Aquatic Insects, Butterfly Effect, Cuckoo for Coconuts, Fruit Dissection, Gardening, Ginger, Great Globes of Garlic, Guerrilla Gardening, Gastropod Gastronomy, Going on a Bug Hunt, Humongous Fungus, Metamorphosis, Mexican Jumping Bean, Mosquito Patrol, Mosquitoes Suck, Plant Babies, Wonderful Wacky Whatsits, Yeastie Beasties***

**Secondary/Supporting Standard: *Aw, Shoots!, Beaver Fever, Corny Little Explosions, Crunchy Crickets, Earthworms, Eggs, Egg Dissection, I'm Being Followed by a Moonjelly, Learning About Limulus, NC Bacteria 500, Roach Motel, Rootbeer, Salamander Gander, Seed Travelers, Turtle Hurdles, Watch Out for Falling Leaves, ZZZZZZ***

**3-LS2 Ecosystems: Interactions, Energy, and Dynamics**

**3-LS2-1**

**Construct an argument that some animals form groups that help members survive.**

**Targeted Standard: *Ant Farm, Bean Trek Forager, Beaver Fever, Gnome Ecology, Never Cry Wolf, ZZZZZZ***

**Secondary/Supporting Standard: *Camouflage and Stalking, Deer Survival, ~Predator Prey, Web of Life, Wonderful Wandering Whatsits***

**3-LS3 Heredity: Inheritance and Variation of Traits**

**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.** [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]

**Targeted Standard: *Ant Farm, Code of Life, DNA Extract, Designer Genes, Feed the Birds, ICARUS, Spiderman, A Tail of Two Rabbits, ZZZZZZ***

**Secondary/Supporting Standard: *A-Maze-ing, Animal Communication, Animal Behavior, Animation, Arachnids, Bats Incredible, Bug Out, Camouflage and Stalking, Earthworms, Fish Prints, Flatten Flora, For the Birds, Fox Prints, Guerrilla Gardening, Invent-a-Beast, Jelly Bellyology, Key Me, Live Animal Tracking, ~Night Experience, Oo Oo That Smell, Plant Babies***

**3-LS3-2.**

**Use evidence to support the explanation that traits can be influenced by the environment.**

[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]

**Targeted Standard: *Animal Behavior, Bug Out, Code of Life, DNA Extract, Earthworms, Ice is Nice, Population Dynamics, Ring Around the Tree, Watery Wonders, ZZZZZZ***

**Secondary/Supporting Standard: *Advanced Camouflage, A-Maze-ing, Animal Camouflage, The Appalachian***

***Trail, Build a Civilization, Desert Heat, Designer Genes, Don't Dis Professor X, Gnome Ecology, Holy Cave It's Dark in Here, Ice Fishing, Key Me, Leaf Me Alone, ~Night Experience, Pipe-a-saurus Park, Plant Response Meter, Plants Have Homes Too, Seed Racers, What's Out There?, What's Transpiring, You Are What You Eat***

### **3-LS4 Biological Evolution: Unity and Diversity**

#### **3-LS4-1.**

**Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]

**Targeted Standard: *The Older the Better***

**Secondary/Supporting Standard: *Chalk it Up, Fantastic Fossils, Pangaea Mapping, Time Travel***

#### **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.** [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

**Targeted Standard: *Advanced Camouflage, Animal Camouflage, Bug Out, Camouflage and Stalking, Deer Survival, Feed the Birds, The Great American Bean Hunt, Pipe-a-saurus Park, ~Predator Prey, ~Savage Ravage, Turtle Hurdles, Web of Life, ZZZZZZ***

**Secondary/Supporting Standard: *Arachnids, Bats Incredible, Beaver Fever, Butterfly Effect, Come Clean, DNA Extract, Eggs, Gyotaku, How to Be a Super Starfish, Invent-a-Beast, Learning About Limulus, Oo Oo That Smell, Scorpions Are Your Friends, Spiderman, Walk On Water, Web of Life***

#### **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.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

**Targeted Standard: *Blue Bird Bungalows, Bug Out, Camouflage and Stalking, The Great American Bean Hunt, Earthworms, Feed the Birds, Let's Glow (Bio-luminescence), Mosquito Patrol, Population Dynamics, Walk On Water, Watery Wonders, What's Out There, ZZZZZZ***

**Secondary/Supporting Standard: *Advanced Camouflage, Animal Camouflage, Amok in the Muck, Aquarium Construction, Crabbing, Don't Dis Professor X, Gnome Ecology, Gyotaku, Holy Cave it's Dark in Here, How to Be a Super Starfish, Learning About Limulus, Marsh Madness, Metamorphosis, ~Night Experience, ~The Oregon Trail, Pipe-a-saurus Park, Polar Bear Necessities, ~Predator Prey, Roach Motel, Rootbeer, ~Savage Ravage, Squid Dissection, Tank Aquaculture, Tree Tag, Turtle Hurdles, Weeds of the Sea, Where There's a Quill There's a Way, Wonderful Wandering Whatsits, Wood Ducks***

#### **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.** [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other

organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

**Targeted Standard: *What's Out There?***

**Secondary/Supporting Standard: *Build a Civilization, Orienteering/ Mapping, Recycled Ort, Ring Around the Tree, Sam the Clam***

### **3-ESS2 Earth's Systems**

#### **3-ESS2-1.**

**Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.** [Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]

**Targeted Standard: *Igloo Making, Thunderstorms, Weather or Not***

**Secondary/Supporting Standard: *Go Fly a Kite, Life Under Ice, Swim For Your Lives, What's Transpiring***

#### **3-ESS2-2.**

**Obtain and combine information to describe climates in different regions of the world.**

**Targeted Standard: *Biome Building, A Straining Forest, Swim For Your Lives, Weather or Not***

**Secondary/Supporting Standard: *Desert Heat, Ice Wars, Cloud Appreciation, H2UhOh, Ice Cubes and Glaciers, Nature's Shapes, Snowflakes and Ice Crystals***

### **3-ESS3 Earth and Human Activity**

#### **3-ESS3-1.**

**Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.** [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]

**Targeted Standard: *Build a Civilization, H2UhOh, Sand Castles, Swim For Your Lives, Thunderstorms***

**Secondary/Supporting Standard: *Atomic Ice, Please Pass the Salt***



## Fourth Grade:

### 4-PS3 Energy

#### 4-PS3-1.

**Use evidence to construct an explanation relating the speed of an object to the energy of that object.**

[Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.]

**Targeted Standard: *Have a Ball, Mile-a-Minute Murphy, A Really Really Bad Day, Snow Down You're Moving Too Fast, Xstream***

**Secondary/Supporting Standard: *Batmobiles, Get a Half Life, Going with the Flow, Juggle, ~Science Fair, Trebuchets and Catapults***

#### 4-PS3-2.

**Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.** [Assessment Boundary: Assessment does not include quantitative measurements of energy.]

**Targeted Standard: *Alternative Energy, Atomic Ice, Batmobiles, Chef Sun Beam, Corny Little Explosions, Digital Junk, Electronic Motor, Electronics, Electroplating, Glow Power, Harnessing the Sun, Heat Waves, Light the Afterburner, Making Electricity, ~Night Experience, Now Hear This, Nuclear Power, Please Pass the Salt, Radios, Solar Energy, Sounds Good To Me, Thunderstorms, Twilight Zone, Wave Bye Bye, Weird Noises, You Light Up My Life***

**Secondary/Supporting Standard: *Chemistry Magic, Electrifying, Field of Dreams, Fire and Explosions, Get a Half Life, Hack it Up, Ickle Me Pickle Me, Let's Glow (Bioluminescence), Martha Stewart's Chemical Rockets, Rainbow Connection, Somewhere Over the Rainbow, ~Science Fair, Water Rockets, What's Happening***

#### 4-PS3-3.

**Ask questions and predict outcomes about the changes in energy that occur when objects collide.**

[Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]

**Targeted Standard: *Glow Power, Xstream***

**Secondary/Supporting Standard: *Asteroids, Get a Half Life, Have a Ball, Juggle, Mile-a-Minute Murphy, A Really Really Bad Day, ~Science Fair, Trebuchets and Catapults***

#### 4-PS3-4.

**Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.**

[Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]

**Targeted Standard: *Atomic Ice, Chef Sun Beam, Electronic Motor, Electroplating, Glow Power, Harnessing the Sun, Heat Waves, Light the Afterburners, Mousetrap, Mousetrap Catapults, ~Night Experience, Piezo Power, Please Pass the Salt, Solar Energy, Speed Boats, Thunderstorms, You Light Up My Life***

**Secondary/Supporting Standard: *Alternative Energy, Breathe Deeply, Chemistry Magic, Digital Junk, Electronics, Hot Air Balloons, How to Cross a Desert, Making Electricity, Martha Stewart's Chemical Rockets,***

***Nuclear Power, The Old Mill Stream, Plumping Mill, ~Science Fair, This Class Will Blow You Away, Water Rockets, What's Happening, Wind Energy, Wind Power***

#### **4-PS4 Waves and their Applications in Technologies for Information Transfer**

##### **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.** [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]

**Secondary/Supporting Standard: *Now Hear This***

##### **4-PS4-2.**

**Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.** [Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]

**Targeted Standard: *Candlelight Science, Double Bubble Trouble, Giant Pinhole Camera, Glow Power, LASER, ~Night Experience, Rainbow Connection, Somewhere Over the Rainbow***

**Secondary/Supporting Standard: *Crystals, Field of Dreams, Lies, Piezo Power***

##### **4-PS4-3.**

**Generate and compare multiple solutions that use patterns to transfer information.** [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]

**Secondary/Supporting Standard: *Now Hear This***

#### **4-LS1 From Molecule to Organisms: Structures and Processes**

##### **4-LS1-1.**

**Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

**Targeted Standard: *Advanced Camouflage, Animate, Aquatic Insects, Arachnids, Bats Incredible, Beaver Fever, Butterfly Effect, Camouflage and Stalking, Code of Life, Crunchy Crickets, Cuckoo for Coconuts, Deer Survival, Desert Heat, Dissections, Earthworms, Endangered Egg Babies, Fish Prints, Fox Prints, Fruit Dissection, Gardening, Gastropod Gastronomy, Gnome Ecology, Going on a Bug Hunt, Great Globes of Garlic, Guerrilla Gardening, Gyotaku, How to Be a Super Starfish, Humongous Fungus, Invasion of the Worms, Leaf Me Alone, Let's Face It, Let's Glow (Bioluminescence), Marsh Madness, Mosquitoes Suck, Mr Potato Head, Never Cry Wolf, Nice to Meat You, ~Night Experience, Pipe-a-saurus Park, Polar Bear Necessities, Oo Oo That Smell, Plant Babies, Poisonous Plants & Potions, Potato Porcupines, ~Predator Prey, Seed Racers, Roach Motel, Salamander Gander, Scat, Scorpions Are Your Friends, Sheep Heart and Lung Dissection, Spiderman, Squid Dissection, Stalking, A Tail of Two Rabbits, Taxidermy, Tree Tag, Tye Dye Flowers, Web of Life, Where There's a Quill There's a Way, Who Puked? (Owls), Wood Ducks, Woolly Woolly, Walk On Water, Watch Out for Falling Leaves, What's Out There?, What's Transpiring, Where Have All of the Flowers Gone, ZZZZZZ***

**Secondary/Supporting Standard: *Amok in the Muck, Animal Behavior, Ant Farm, Aw Shoots!, Baa-Baa Black***

*Sheep, Bones, Bug Out, Burnt Nuts, Catazymes, Chemical Attraction, Come Clean, Crabbing, Don't Dis Professor X, Eggs, Feed the Birds, Flatten Flora, For the Birds, Ginger, The Great American Bean Hunt, The Heart of the Matter, Holy Cave It's Dark in Here, Human Brain Dissection, Ice Is Nice, I'm being followed by a Moonjelly, Inside Out Kid, Invent-a-Beast, Jelly Bellyology, Key Me, Kitchen Paleontology, Learning About Limulus, Let's get Physical, Live Animal Tracking, Mexican Jumping Bean, Mosquito Patrol, No Bones About It, Now Hear This, Orienteering/ Mapping, Seed Traveler, Snot Making, Tea Time, Turtle Hurdles, Vampire Survival, Weeds of the Sea, Wonderful Wandering Whatsits*

**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.** [Clarification Statement: Emphasis is on systems of information transfer.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]

**Targeted Standard:** *A-maze-ing, Animal Behavior, Animal Communication, Don't Dis Professor X, Mime of Nature, Nature Journaling, ~Night Experience*

**Secondary/Supporting Standard:** *Another Land Another Place, Butterfly Effect, Explore Your Senses, Going on a Bug Hunt, Holy Cave It's Dark In Here, Huckin' Stuff, Insect Torture, Lies, Making Sense, Mosquitoes Suck, Where There's a Quill there's a Way*

**4-ESS1 Earth's Place in the Universe**

**4-ESS1-1.**

**Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.** [Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.]

**Targeted Standard:** *Holy Cave It's Dark in Here, The Older the Better, Pangea Mapping, This Rocks, Time Travel*

**Secondary/Supporting Standard:** *Chalk it Up, Earthquake, Sands of Time, Soil Is Not Just Dirt, What's in Your Water?, Xstream*

**4-ESS2 Earth's Systems**

**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.** [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]

**Targeted Standard:** *Build a Civilization, Glaciation, Glaciers: The Great Importer of Rocks, Highs and Lows, Holy Cave It's Dark in Here, H2UhOh, Ice Cubes and Glaciers, Nature's Shapes, The Old Mill Stream, Plumping Mill, A Straining Forest, Sand Castles, Thunderstorms, Xstream*

**Secondary/Supporting Standard:** *Atomic Ice, Bog Jog Sneaker Squeaker, Chalk it Up, Don't Push Hunter to the*

***Boiling Point, Ice is Nice, Life Under Ice, Oh Well, Run For Your Lives, Sands of Time, Soil Is Not Just Dirt, Stained Glass, Stream-Dam It, Swim For Your Lives, This Rocks, Trailblazing, Up on the Watershed, Water Game***

**4-ESS2-2.**

**Analyze and interpret data from maps to describe patterns of Earth's features.** [Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]

**Targeted Standard: *Basic Orienteering, Biome Building, Clinometers, Contour Carnival, Get Lost, H2UhOh, Pangaea Mapping, Staying Alive, Volcanoes***

**Secondary/Supporting Standard: *The Appalachian Trail, Earthquake, Exploring, Holy Cave It's Dark in Here, It All Flows Downhill, ~The Oregon Trail, Run For Your Lives, Soil Is Not Just Dirt, What's in Your Water***

**ESS3 Earth and Human Activity**

**4-ESS3-1.**

**Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.** [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]

**Targeted Standard: *Gardening & Compost, Get a Half Life, H2UhOh, Oil Game, Stream-Dam It***

**Secondary/Supporting Standard: *Chef Sun Beam, Go Fly A Kite, Mutant Moths, The Old Mill Stream, Plumping Mill, Plastic SMASHtics, Recycled Ort, Water Game, What's in Your Water***

**4-ESS3-2.**

**Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.**

[Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

**Targeted Standard: *Bridge That, Bridge Over Troubled Water, Build it Your Way, Burma Bridge, Hang In There, Harnessing the Sun, Light the Afterburner, Run For Your Lives, Solar Energy, Wind Power***

**Secondary/Supporting Standard: *Please Pass the Salt, Swim For Your Lives, Volcanoes***

## Fifth Grade:

### 5-PS1 Matter and its Interactions

#### 5-PS1-1.

**Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]

**Targeted Standard:** *Blown Up With Air, CD Hovercraft, Distillation, Double Bubble Trouble, H2Whoa, Hot Air Balloons, Kitchen Chemistry, Oh Chutes, Oozes Slimes and Mud, Shampoo Sham, Sugar Coated Chemistry, Vinegar Magic*

**Secondary/Supporting Standard:** *Are You Dense, Aztec Warrior, Chemical Attraction, Crystals, Get a Half Life, It's Not Easy Being Cheesy, Oo Oo That Smell, Rootbeer, ~Science Fair, Scope It Out, Soda Popinski, Tea Time, Udderly Cool, Weird Food*

#### 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.** [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]

**Targeted Standard:** *Chemical Reactions, Come Clean, Crystals, Distillation, Don't Push Hunter to the Boiling Point, Mentos Eruption, Oozes Slimes and Mud, Rootbeer, Sugar Coated Chemistry, Thunderstorms*

**Secondary/Supporting Standard:** *Alchemy, Atomic Ice, Blown Up With Air, Build a Civilization, Chemical Attraction, Chemistry Magic, Double Bubble Trouble, Fire and Explosions, Get a Half Life, It's Not Easy Being Cheesy, Oo Oo That Smell, Please Pass the Salt, Rocket Fuel, Soda Popinski, This Rocks, Udderly Cool*

#### 5-PS1-3.

**Make observations and measurements to identify materials based on their properties.** [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]

**Targeted Standard:** *Alchemy, Awesome Acids, Chalk it Up, Chemical Attraction, Chemistry Magic, A Class on Cloth, Come Clean, Crystals, Distillations, Electroplating, Fire and Explosions, Get a Half Life, H2Whoa, Holy Cave It's Dark in Here, Icky Sticky, Live By The Sword, Kitchen Chemistry, Magnetism, Making Slime, Mentos Eruption, Oozes Slimes and Mud, Shampoo Sham, Weird Food, What's Happening*

**Secondary/Supporting Standard:** *Are You Dense, Catzymes, Chemical Reactions, Digital Junk Dissection, Disgusting!, Don't Push Hunter to the Boiling Point, Duck Tapeology, Egg Dissection, Electrifying, Field of Dreams, Glow Power, Ickle Me Pickle Me, I Love Lemons, It's Not Easy Being Cheesy, ~Night Experience, Oo Oo That Smell, Piezo Power, Plastic SMASHTics, Rock N Roll, ~Science Fair, Sugar Coated Chemistry, This Rocks Udderly Cool, Vinegar Magic*

#### 5-PS1-4.

**Conduct an investigation to determine whether the mixing of two or more substances results in new substances.**

**Targeted Standard:** *Alchemy, Awesome Acids, Chalk it Up, Chemical Attraction, Chemical Reactions,*

***Chemistry Magic, Distillations, Fire and Explosions, Holy Cave It's Dark in Here, Rocket Fuel, This Rocks, What's Happening***

**Secondary/Supporting Standard: *Catazymes, Concrete Structures, Icky Sticky, Live By The Sword, Making Slime, Mentos Eruption, Oozes Slimes and Mud***

### 5-PS2 Motion and Stability: Forces and Interaction

#### 5-PS2-1.

**Support an argument that the gravitational force exerted by Earth on objects is directed down.** [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.]

[Assessment Boundary: Assessment does not include mathematical representation of gravitational force]

**Targeted Standard: *Avalanche, Bad Spin, Bernoulli and The Magical Puffer, Blast Off, Bombs Away, Bounce, Bounce with Me, Boomerangs, Bridge That, Bridge Over Troubled Water, Build It Your Way, Burma Bridge, CD Hovercraft, Concrete Structures, Geodome, Geodome 2.0, Going with the Flow, Hack it Up, Handle With Care, Hang Gliders, Hang In There, Have a Ball, Helicopters, Highs and Lows, Hot Air Balloons, It all Flows Downhill, Juggle, Just Plane Fun, Marbleized Paper, Martha Stewart's Chemical Rockets, Mousetrap, Mousetrap Catapults, Oh Chute, Oh Well, The Old Mill Stream, One in Harmony, Pendulum Principles, Plumping Mill, Projectile Motion, Propellers and Puddlejumpers, Rube Goldberg Machines, Run For Your Lives, Santosotep's Tomb, Snow Down You're Moving Too Fast, Snowflakes and Ice Crystals, Soda Can Steamboats, Speed Boats, Tower, Tower of Power, Trebuchets and Catapults, Ultimate, Ups and Downs, Water Rockets***

**Secondary/Supporting Standard: *Ant Farm, All Geared Up, Batmobiles, Bug Out, Distillation, Earthworms, Feed the Birds, Field of Dreams, Float Yar Boat, Go Fly a Kite, Mega-Structures, Mile-a-Minute Murphy, Mini-Structures, Piezo Power, Pulleys, ~Science Fair, Thunderstorms, Walk On Water, What Floats On What, Xstream***

### 5-PS3 Energy

#### 5-PS3-1.

**Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.** [Clarification Statement: Examples of models could include diagrams, and flow charts.]

**Targeted Standard: *Aw Shoots!, Mr. Potato Head, Nice to Meat You, Sugar on Snow, World Builder***

**Secondary/Supporting Standard: *Breathe Deeply, Burnt Nuts, Corny Little Explosions, Fruit Dissection, Solar Power, Tie Dye Flowers, Watch Out for Falling Leaves***

### 5-LS1 From Molecules to Organisms: Structures and Processes

#### 5-LS1-1.

**Support an argument that plants get the materials they need for growth chiefly from air and water.**

[Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

**Targeted Standard: *Desert Heat, Hydroponics, Potato Porcupines, Terrarium Construction, Tie Dye Flowers, Watch Out for Falling Leaves***

**Secondary/Supporting Standard: *Build a Civilization, Gardening & Compost, Cuckoo for Coconuts, Ginger, Great Globbs of Garlic, Guerrilla Gardening, It all Flows Downhill, Plant Babies, Plants Have Homes Too, Tea***

***Time, Tree Tag, What's Transpiring***

**5-LS2 Ecosystems: Interactions, Energy, and Dynamics**

**5-LS2-1.**

**Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.** [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

**Targeted Standard: *Amok in the Muck, Chalk it Up, Elves and Trolls, NC Bacteria 500, ~Predator Prey, REcycled Ort, ~Savage Ravage, Sugar on Snow, Tank Aquaculture, Terrarium Construction, Web of Life, Worm City***

**Secondary/Supporting Standard: *Bean Trek Forager, Beaver Fever, Biome Building, Come Clean, Dirty Looks, Garbage Dissection, Gardening & Compost, Orienteering/Mapping, Humongous Fungus, I Want My Mummy, Invasion of the Worms, It all Flows Downhill, Marsh Madness, Mr Potato Head, Oh Well, Plants Have Homes Too, Potato Porcupines, Soil is More Than Just Dirt, Wonderful Wandering Whatsits, World Builder***

**5-ESS1 Earth's Place in the Universe**

**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 Earth.** [Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).]

**Targeted Standard: *~Planetarium Show, Portable Planetarium, Sky Lab, Starlight Starbright***

**Secondary/Supporting Standard: *Astroman, Chef Sun Beam, ~Night Experience, Sundials, That's Astronomical***

**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.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]

**Targeted Standard: *Astroman, Holy Cave It's Dark In Here, ~Planetarium Show, Portable Planetarium, Sundials***

**Secondary/Supporting Standard: *My Planet is Bigger Than Yours, ~Night Experience, Skylab, That's Astronomical, Voyager***

**5-ESS2 Earth's Systems**

**5-ESS2-1.**

**Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.** [Clarification Statement: Examples could include the influence of the ocean on ecosystems, land form shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary:

Assessment is limited to the interactions of two systems at a time.]

**Targeted Standard:** *Build a Civilization, Chalk it Up, Dirty Looks, Edible Volcanoes, Earthquake, H2UhOh, Highs and Lows, Ice Cubes and Glaciers, Ice Is Nice, It all Flows Downhill, Rock N Roll, Run For Your Lives, Sculpting the Earth, Soil is More Than Just Dirt, A Straining Forest, Swim For Your Lives, Terrarium Construction, This Rocks, Water Game, Watery Wonders, Weather or Not, What's in Your Water*

**Secondary Standard:** *Biome Building, Desert Heat, Cloud Appreciation, Don't Push Hunter to the Boiling Point, Get a Half Life, H2Whoa, Nature's Shapes, Oh Well, Pangea Mapping, Population Dynamics, ~Predator Prey, ~Savage Ravage, Snowflakes and Ice Crystals, Thunderstorms, Up on the Watershed, Web of Life*

**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. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]

**Secondary/Supporting Standard:** *Going with the Flow, H2Whoa, It All Flows Downhill, Oh Well, Up on the Watershed, Water Game, What's in Your Water*

**5-ESS3 Earth and Human Activity**

**5-ESS3-1.**

Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

**Targeted Standard:** *Alternative Energy, Garbage Dissection, Gardening & Compost, Crunchy Crickets, Gasping For Air, Get a Half Life, H2UhOh, How to Cross a Desert, It All Flows Downhill, Oil Game, Plastic SMASHtics, Run For Your Lives, Sam the Clam, Sand Castles, Saw Mill Visit, This Class Will Blow you Away, Trailblazing, Turtle Hurdles, Water Game, Watery Wonders, What's in Your Water, We the People, Wind Energy, Worm City*

**Secondary/Supporting Standard:** *The Appalachian Trail, Blue Bird Bungalows, Charles River, Dirty Water, Dominoes, ~Environmental Hearing, Feed Your Face, Go Fly A Kite, Guerrilla Gardening, Ice Cubes and Glaciers, Invasion of the Worms, Leave No Trace, ~The Oregon Trail, Potato Porcupines, Stream-Dam It, Trial of the Lorax, Up on the Watershed, Wood Ducks*



## Grades 3-5:

### 3-5-ETS1 Engineering Design

#### 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.

**Targeted Standard:** *Batmobiles, Blast Off, Concrete Structures, Digital Junk Dissection, Egg Mobile, Electric Motor, Electronics, Electroplating, Hang Gliders, Helicopters, Hot Air Balloon, How to Cross the Desert, ~Invention Convention, Look at 'Em Go, Making Electronics Mousetrap Catapult, Oh Chute, The Old Mill Stream, Pendulum Principles, Plumping Mill, Rube Goldberg Machines, Scope It Out, Small Engine Construction, Soda Can Steamboats, This Class Will Blow You Away, Trailblazing, Ups and Downs, Wind Energy, Wind Power, You Light Up My Life*

**Secondary/Supporting Standard:** *Blown Up With Air, Bridge Over Troubled Water, Build a Civilization, Build it Your Way, Burma Bridge, CD Hovercraft, Chef Sun Beam, Giant Pinhole Camera, ~Science Fair, Sundials, Tower of Power, Walk On Water, Wood Ducks*

#### 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.

**Targeted Standard:** *Martha Stewart's Chemical Rockets, That's Shocking*

**Secondary/Supporting Standard:** *Bridge That, Bridge Over Troubled Water, Corny Little Explosions, Freaks of Nature, ~Invention Convention, Trebuchets and Catapults, Water Rockets*

#### 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.

**Targeted Standard:** *Trebuchets and Catapults*

**Secondary/Supporting Standard:** *Alchemy, Bounce With Me, Bombs Away, Eat Drink Sleep, Look At 'Em Go, Mentos Eruption, Snow Down You're Going Too Fast*

## Grades 6-8 (Middle School):

### MS-PS1 Matter and Its Interactions

#### MS-PS1-1.

**Develop models to describe the atomic composition of simple molecules and extended structures.**

[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.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of sub-units of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.]

***Targeted Standard:*** *Atom Builders, Crystals, Distillation, Double Bubble Trouble, Oo Oo That Smell, Sugar Coated Chemistry*

***Secondary/Supporting Standard:*** *Alchemy, Blown Up With Air, Chemical Attraction, Chemical Reactions, Code of Life, Come Clean, Don't Push Hunter to the Boiling Point, H2Whoa, Mentos Eruption, Rootbeer, Shampoo Sham, Soda Popinski*

#### 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.** [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with HCl.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]

***Targeted Standard:*** *Alchemy, Blown Up With Air, Catalyzes, Chalk it Up, Chemical Attraction, Chemical Reaction, Come Clean, Crystals, Fire and Explosions, Icky Sticky, I Love Lemons, Making Slime, Oozes Slimes and Mud, Rocket Fuel, Vinegar Magic*

***Secondary/Supporting Standard:*** *Aw, Shoots!, Awesome Acids, Breathe Deeply, Chemistry Magic, Egg Dissection, ~Science Fair, What's Happening*

#### MS-PS1-3.

**Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.** [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.] [Assessment Boundary: Assessment is limited to qualitative information.]

***Targeted Standard:*** *Candlelight Science, Come Clean, Corny Little Explosions, Crystals, Disgusting!, Distillation, Ickle Me Pickle Me, It's Not Easy Being Cheesy, Live By The Sword, Nuclear Power, Oo Oo That Smell, Plastic SMASHtics, Save the World, Shampoo Sham, Soda Can Steamboats, Udderly Cool, Weird Food*

***Secondary/Supporting Standard:*** *Are You Dense, Atom Builders, Awesome Acids, Chemical Attraction, Chemistry Magic, Come Clean, Crunchy Munchies: Granola Making, Duck Tapeology, Electrifying, Glow Power, Icky Sticky, I Love Lemons, Light the Afterburner, Making Slime, Marbleized Paper, Nice to Meat You, Oozes Slimes and Mud, Piezo Power, Rocket Fuel, Rootbeer, Sugar Coated Chemistry, Take Two Dandelions, Tea Time, Walk on Water, What's Happening*

#### MS-PS1-4.

**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.** [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.]

**Targeted Standard:** *Chemical Attraction, Chemical Reaction, Chemistry Magic, Crystals, Distillation, Fire and Explosions, Rocket Fuel, What's Happening*

**Secondary/Supporting Standard:** *Atom Builders, Atomic Ice, Awesome Acids, Blown Up With Air, Don't Push Hunter to the Boiling Point, Hot Air Balloons, Nuclear Power, Oo Oo that Smell, Please Pass the Salt, ~Science Fair, Sugar Coated Chemistry, Tea Time, Thunderstorms*

#### **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.** [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]

**Secondary/Supporting Standard:** *Alchemy*

#### **MS-PS1-6.**

**Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.** [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.] [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.]

**Targeted Standard:** *Fire and Explosions, I Love Lemons, Nuclear Power, Oozes Slimes and Mud, Rocket Fuel, Thunderstorms*

**Secondary/Supporting Standard:** *Alchemy, Atomic Ice, Blast Off, Chemical Attraction, Chemistry Magic, Glow Power, Please Pass the Salt, ~Science Fair, What's Happening*

### **MS-PS2 Motion and Stability: Forces and Interactions**

#### **MS-PS2-1.**

**Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.** [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.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]

**Targeted Standard:** *Asteroids, Propellers and Puddlejumpers, A Really, Really Bad Day*

**Secondary/Supporting Standard:** *Hack It Up, Have a Ball, Juggle, Trebuchets and Catapults, Ultimate*

#### **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.** [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.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]

**Targeted Standard:** *All Geared Up, Avalanche, Batmobiles, Bounce, Bounce with Me, Hack It Up, Heat Waves,*

***Helicopters, Juggle, Light the Afterburner, Look at 'Em Go, Making Sense of Physics, Martha Stewart's Chemical Rockets, Oh Chute, Rube Goldberg Machines, Soda Can Steamboats, Trebuchets and Catapults, Ups and Downs, Water Rockets***

**Secondary Standard: *All Geared Up, Bad Spin, Bernoulli and the Magical Puffer, Blast Off, Boomerang, Bridge That, Bridge Over Troubled Water, Build It Your Way, Burma Bridge, Burnt Nuts, CD Hovercraft, Float Your Boat, Hang In There, Have a Ball, Highs and Lows, Hot Air Balloons, How to Cross a Desert, Mile-A-Minute Murphy, Mousetrap, Mousetrap Catapults, Plane Fun, Snow Down You're Moving Too Fast, Pendulum Principles, Piezo Power, Projectile Motion, Santosotep's Tomb, ~Science Fair, This Class Will Blow You Away, Walk on Water, What Floats On What, Wind Energy***

#### **MS-PS2-3.**

**Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.**

[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.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]

**Targeted Standard: *Batmobiles, Digital Junk Dissection, Liquid Love and Attraction, Magnetic Field, Magnetism***

**Secondary/Supporting Standard: *Asteroids, Compass and Design, Electric Motor, Electronics, Electroplating, Making Electronics, Walk on Water***

#### **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.** [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.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]

**Targeted Standard: *Field of Dreams, Highs and Lows, Rube Goldberg Machines***

**Secondary/Supporting Standard: *Batmobiles, Tower of Power, Ultimate***

#### **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.** [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.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.]

**Targeted Standard: *Asteroids, Ben Franklin's Bells, Bernoulli and the Magical Puffer, Boomerangs, Field of Dreams, Just Plane Fun, Liquid Love and Attraction, Magnetic Field, That's Shocking***

**Secondary/Supporting Standard: *Electrifying, Hot Air Balloons, Magnetism, Walk on Water***

### **MS-PS3 Energy**

#### **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.** [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 whiffle ball versus a tennis ball.]

***Targeted Standard:*** *Bounce with Me, Hang Gliders, Have a Ball, Juggle, Mile-A-Minute Murphy, Mousetrap, Mousetrap Catapults, A Really, Really Bad Day, Rube Goldberg Machines, Snow Down You're Moving Too Fast, Woolly Woolly, Xstream*

***Secondary/Supporting Standard:*** *Bounce, Blast Off, Hack it Up, Look at 'Em Go, Making Sense of Physics, The Old Mill Stream, Plumping Mill, Trebuchets and Catapults*

#### **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.** [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.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]

***Targeted Standard:*** *Bounce, Bounce with Me, Electrifying, Field of Dreams, Going with the Flow, Hang Gliders, Mile-A-Minute Murphy, Mousetrap, Mousetrap Catapults, Piezo Power, Projectile Motion, Santosotep's Tomb, Rube Goldberg Machines, Snow Down You're Moving Too Fast, Thunderstorms, Xstream*

***Secondary/Supporting Standard:*** *Ben Franklin's Bells, Blown Up With Air, Hack It Up, Have a Ball, Juggle, Making Sense of Physics, Pendulum Principles, A Really Really Bad Day, ~Science Fair, Speed Boats*

#### **MS-PS3-3.**

**Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.** [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]

***Targeted Standard:*** *Chef Sun Beam*

***Secondary/Supporting Standard:*** *Atomic Ice, Blast Off, Hot Air Balloons, Please Pass the Salt*

#### **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.** [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.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]

***Targeted Standard:*** *Atomic Ice, Burnt Nuts, Please Pass the Salt, Soda Can Steamboats, Solar Energy*

***Secondary/Supporting Standard:*** *Blown Up With Air, Rube Goldberg Machines*

#### **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.** [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.] [Assessment Boundary: Assessment does not include calculations of energy.]

**Targeted Standard:** *Bounce with Me, Egg Mobiles, Hack it Up, Heat Waves, Hot Air Balloons, Light the Afterburners, Piezo Power, Speed Boats, Solar Energy, Wind Power*

**Secondary/Supporting Standard:** *Atomic Ice, Blast Off, Bounce, Breathe Deeply, Hang Gliders, Making Sense of Physics, Martha Stewart's Chemical Rockets, Mile-A-Minute Murphy, ~Night Experience, Nuclear Power, Oh Chute, Please Pass the Salt, A Really Really Bad Day, ~Science Fair, Small Engine Construction, Soda Can Steamboats, This Class Will Blow You Away, Water Rockets, Wind Energy*

#### **MS-PS4 Waves and Their Applications in Technologies for Information Transfer**

##### **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.** [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]

##### **MS-PS4-2.**

**Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.** [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]

**Targeted Standard:** *Chef Sun Beam, Crystals, Giant Pinhole Camera, Now Hear This, Rainbow Connection, Solar Energy, Somewhere Over the Rainbow, Sounds Good To Me, Up Periscope, Wave Bye Bye, Weird Noises*

**Secondary/Supporting Standard:** *Alternative Energy, Candlelight Science, Digital Junk Dissection, Double Bubble Trouble, Field of Dreams, Radios*

##### **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.** [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.] [Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]

**Targeted Standard:** *Digital Junk Dissection*

**Secondary/Supporting Standard:** *Field of Dreams*

#### **MS-LS1 From Molecules to Organisms: Structures and Processes**

##### **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.** [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.]

**Targeted Standard:** *Code of Life, DNA Extract, Egg Dissection, Fresh Water Microbes, It's a Small World, NC Bacteria 500, Scope It Out, Slide Show Botany, What's Transpiring*

**Secondary/Supporting Standard:** *ICARUS, It's Not Easy Being Cheesy, Key Me, Jelly Bellyology, Rootbeer, Udderly Cool, What's Out There, Wonderful Wandering Whatsits, Woolly Wooly, Yeastie Beasties*

**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.** [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.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]

**Targeted Standard:** *Code of Life, DNA Extract, Egg Dissection*

**Secondary/Supporting Standard:** *Corny Little Explosions, It's a Small World, Nice to Meet You, Rootbeer, Save the World*

**MS-LS1-3.**

**Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.** [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]

**Targeted Standard:** *Catazymes, Code of Life, DNA Extract, Egg Dissection, How to Be a Super Starfish, Feed Your Face, Eat Sleep Drink, Go with the Flow: A Study of Blood, Grossology, The Heart of the Matter, Inside Out Kid, Kitchen Paleontology, No Bones About It, Sheep Heart and Lung Dissection, Snot Making, Squid Dissection, Taxidermy, Vampire Survival, You Are What You Eat, ZZZZZZ*

**Secondary/Supporting Standard:** *Breathe Deeply, Chemical Attraction, Come Clean It's a Small World, Don't Dis Professor X, Explore Your Senses, Eater's Digest, Four True Colors, Human Brain Dissection, Let's Face It, Let's Get Physical, Nice to Meet You, ~Night Experience, Oo Oo that Smell, Roach Motel, Scat!, Scorpions Are Your Friends*

**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.** [Clarification Statement: 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. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]

**Targeted Standard:** *Ant Farm, Cuckoo for Coconuts, Earthworms, Egg Dissection, Eggs, Feed the Birds, For the Birds, Fruit Dissection, Gardening, Great Globes of Garlic, Guerrilla Gardening, Humongous Fungus, ICARUS, Mexican Jumping Bean, Mosquitoes Suck, Never Cry Wolf, Plant Babies, ~Predator Prey, Seed Racers, Spiderman, Turtle Hurdles, Wood Ducks*

**Secondary/Supporting Standard:** *A-Maze-ing, Advanced Camouflage, Animal Camouflage, Animal Communication, Beaver Fever, Bug Out, Butterfly Effect, Camouflage and Stalking, Crabbing, Crunchy Crickets, Fox Prints, Ginger, Home Tweet Home, Insect Torture, Invent-A-Beast, How to Be a Super Starfish, Poisonous Plants & Potions, Scorpions Are Your Friends, Seed Travelers, Squid Dissection, Tree Tag, Wacky Wonders, What's Transpiring, ZZZZZZ*

**MS-LS1-5.**

**Construct a scientific explanation based on evidence for how environmental and genetic factors influence the**

**growth of organisms.** [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.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]

**Targeted Standard:** *DNA Extract, ~Savage Ravage, Watery Wonders, What's Transpiring*

**Secondary/Supporting Standard:** *Aquatic Insects, ~Back to Basics, Bats Incredible, Bean Trek Forager, Blue Bird Bungalows, Build a Civilization, Burnt Nuts, Butterfly Effect, Camouflage and Stalking, Code of Life, Crabbing, Desert Heat, Ice Wars, Eggs, Fox Prints, Gastropod Gastronomy, Gnome Ecology, The Great American Bean Hunt, Gyotaku, Holy Cave It's Dark in Here, How to Be a Super Starfish, Icefishing, Leaf Me Alone, Mexican Jumping Bean, Plane Response Meter, Population Dynamics, ~Predator Prey, Ring Around the Tree, Rootbeer, Seed Racers, A Tail of Two Rabbits, Turtle Hurdles, Web of Life, What's Out There, Wonderful Wandering Whatsits, Zombie Apocalypse, ZZZZZZ*

#### **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.** [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]

**Targeted Standard:** *Aw, Shoots!, Watch Out For Falling Leaves*

**Secondary/Supporting Standard:** *Breathe Deeply, Fruit Dissection, Gardening & Compost, Mr. Potato Head, Nature's Numbers, Terrarium Construction, Tie Dye Flowers, What's Transpiring*

#### **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.** [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]

**Targeted Standard:** *Aw, Shoots!, Burnt Nuts, Catzymes, Chemical Reactions, Eater's Digest, Mosquito Patrol, NC Bacteria 500, Scat!, Soccer Ball Digestion, Tie Dye Flowers, Yeastie Beasties, You Are What You Eat*

**Secondary/Supporting Standard:** *Code of Life, Come Clean, Crunchy Munchies: Granola Making, DNA Extract, Earthworms, Nice to Meat You, Spiderman, Terrarium Construction, What's Transpiring*

#### **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.** [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]

**Targeted Standard:** *Animal Behavior, Explore Your Senses, Eat Sleep Drink, Lies*

**Secondary/Supporting Standard:** *Animal Communication, Another Land Another Place, The Appalachian Trail, Feed Your Face, The Heart of the Matter, Holy Cave It's Dark in Here, Huckin' Stuff, Mosquitoes Suck, ~Night Experience, Now Hear This*

### **MS-LS2 Ecosystems: Interactions, Energy, and Dynamics**

#### **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.** [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.]

**Targeted Standards:** *Bean Trek Forager, Beaver Fever, Blue Bird Bungalows, Deer Survival, Ice Wars, Orienteering/Mapping, ~Predator Prey, ~Savage Ravage, Watery Wonders, Web of Life*

**Secondary/Supporting Standard:** *Desert Heat, Aquatic Insects, It all Flows Downhill, ~The Oregon Trail, Plants Have Homes Too, Ring Around The Tree, The Spineless Majority, ZZZZZZ*

**MS-LS2-2.**

**Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.**

[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.]

**Targeted Standard:** *Amok in the Muck, Gnome Ecology, Invent-A-Beast, How to Be a Super Starfish, Let's Glow (Bio-luminescence), The Spineless Majority, Stalking, World Builder*

**Secondary/Supporting Standard:** *For The Birds, Gastropod Gastronomy, Insect Torture, Invasion of the Worms, Learning About Limulus, Never Cry Wolf, ~Night Experience, Population Dynamics, ~Predator Prey, Turtle Hurdles, Web of Life, What's Out There, ZZZZZZ*

**MS-LS2-3.**

**Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.**

[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.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]

**Targeted Standard:** *Marsh Madness, Recycled Ort, Soil is More than Just Dirt, World Builder*

**Secondary/Supporting Standard:** *Amok in the Muck, Bog Tog Sneaker Squeaker, Dirty Looks, Invasion of the Worms, Watery Wonders*

**MS-LS2-4.**

**Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.**

[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.]

**Targeted Standard:** *Orienteering/Mapping, A Straining Forest*

**Secondary/Supportive Standard:** *Blue Bird Bungalows, Crunchy Crickets, For the Birds, How to Be a Super Starfish, Ice Wars, It All Flows Downhill, Leaf Me Alone, Marsh Madness, Mutant Moths, ~The Oregon Trail, The Spineless Majority, Watery Wonders, World Builder, Zombie Apocalypse*

**MS-LS2-5.**

**Evaluate competing design solutions for maintaining biodiversity and ecosystem services.\*** [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.]

**Targeted Standard:** *Sam the Clam*

**Secondary/Supporting Standard:** *Elves and Trolls, Garbage Dissection, Gardening & Compost, Invasion of the Worms, It all Flows Downhill, Plants Have Homes Too, Potato Porcupines, Ring Around the Trees*

**MS-LS3 Heredity: Inheritance and Variation of Traits**

**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.** [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.]

**Targeted Standard: *Code of Life, DNA Extract***

**Secondary/Supporting Standard: *Don't Dis Professor X, Mutant Moths***

**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.** [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.]

**Targeted Standard: *\*Designer Genes, \*Marshmallow Breeding, \*Mutant Moths***

**\*Does not include asexual reproduction, emphasis is on genetic variation**

**MS-LS4 Biological Evolution: Unity and Diversity**

**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.** [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.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]

**Targeted Standard: *Pangaea Mapping***

**Secondary/Supporting Standard: *Chalk it Up, Fossils, The Older the Better, Time Travel***

**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.**

[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.]

**Secondary/Supportive Standard: *Arachnids, Flatten Flora, ICARUS, Jelly Bellyology, Key Me, Mr. Potato Head The Older the Better, Slideshow Botany, Walk On Water, What's Out There***

**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.** [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]

**Targeted Standard: *Fetal Pig Dissection***

**Secondary/Supportive Standard: *Metamorphosis***

**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.** [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]

**Targeted Standard:** *Camouflage and Stalking, Eggs, The Great American Bean Hunt, Mutant Moths, What's Out There*

**Secondary/Supporting Standard:** *Code of Life, DNA Extract, For the Birds, Ice Is Nice*

**MS-LS4-5.**

**Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.** [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.]

**Targeted Standard:** *Freaks of Nature, Tank Aquaculture*

**Secondary/Supporting Standard:** *Code of Life, DNA Extract*

**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.** [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]

**Targeted Standards:** *Population Dynamics*

**Secondary/Supporting Standard:** *The Great American Bean Hunt, Watery Wonders*

**MS-ESS1 Earth's Place in the Universe**

**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.** [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]

**Targeted Standard:** *~Night Experience, ~Planetarium Show, Skylab, Sundials, That's Astronomical*

**Secondary/Supporting Standard:** *Highs and Lows*

**MS-ESS1-2.**

**Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.**

[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. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).]

[Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]

**Secondary/Supporting Standards:** *Asteroids, Egg Dissection, My Planet is Bigger Than Yours, ~Planetarium Show, Skylab, Starlight Starbright, That's Astronomical, Twilight Zone, Voyager, What's Out There*

**MS-ESS1-3.**

**Analyze and interpret data to determine scale properties of objects in the solar system.** [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. Examples of data include statistical information, drawings and photographs, and models.]

[Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

**Targeted Standard: *My Planet is Bigger Than Yours, Skylab, That's Astronomical***

**Secondary/Supporting Standard: *~Planetarium Show, Voyager, What's Out There***

#### **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.** [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). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]

**Targeted Standard: *Fossils, Pangea Mapping, This Rocks, Time Travel***

**Secondary/Supporting Standard: *Contour Carnival, Time, What's in Your Water***

### **MS-ESS2 Earth's Systems**

#### **MS-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.]

[Assessment Boundary: Assessment does not include the identification and naming of minerals.]

**Targeted Standard: *Earthquake, Holy Cave It's Dark in Here, Oh Well, Rock N Roll, Run For Your Lives, Sculpting the Earth, This Rocks, Xstream***

**Secondary/Supporting Standard: *Alchemy, Atomic Ice, Chalk it Up, Concreate Structures, Get a Half Life, H2Whoa, Ice Cubes and Glaciers, Please Pass the Salt, A Really Really Bad Day, Sands of Time, Soil Is More Than Just Dirt, Time Travel, Water Bars, What's in Your Water***

#### **MS-ESS2-2.**

**Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.** [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 geo chemical 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.]

**Targeted Standard: *Earthquake, Glaciation, Glaciers: The Great Importer of Rocks, Holy Cave It's Dark in Here, Ice Cubes and Glaciers, Pangea Mapping, A Really Really Bad Day, Run For Your Lives, Swim for Your Lives, This Rocks, Volcanoes, Xstream***

**Secondary/Supporting Standard: *Contour Carnival, Going with the Flow, H2UhOh, Sands of Time, Thunderstorms, What's in Your Water***

**MS-ESS2-3.**

**Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and sea floor structures to provide evidence of the past plate motions.** [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).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]

**Targeted Standard:** *Pangaea Mapping, What's in Your Water*

**Secondary/Supporting Standard:** *Ice Cubes and Glaciers*

**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.** [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.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]

**Targeted Standard:** *Don't Push Hunter to the Boiling Point, H2UhOh, It all Flows Downhill, Oh Well, The Old Mill Stream, Plumping Mill, Sculpting The Earth, Up on the Watershed, Water Game, Watery Wonders, What's Transpiring*

**Secondary/Supporting Standard:** *Atomic Ice, Chemical Attraction, Cloud Appreciation, H2Whoa, Ice Cubes and Glaciers, Life Under Ice, Nature's Shapes, Please Pass the Salt, Snowflakes and Ice Crystals, Thunderstorms, What's in your Water*

**MS-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).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]

**Targeted Standard:** *Swim For Your Lives, Thunderstorms, Weather or Not*

**Secondary/Supporting Standard:** *The Appalachian Trail, Bernoulli and the Magical Puffer, Don't Push Hunter to the Boiling Point, Go Fly a Kite, Hang Gliders, Helicopters*

**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.** [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.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

**Targeted Standard:** *Go Fly a Kite, Swim For Your Lives*

**Secondary/Supporting Classes:** *Biome Building*

### **MS-ESS3 Earth and Human Activity**

#### **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.** [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

**Targeted Standard: *It all Flows Downhill, Oil Game, Trailblazing, What's in Your Water***

**Secondary/Supporting Standard: *Alchemy, Get a Half Life, H2UOh, Live By The Sword, Oh Well, Pangea Mapping, Run For Your Lives, This Rocks, Volcanoes, Xstream***

#### **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.** [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

**Targeted Standard: *Run For Your Lives, Swim For Your Lives***

**Secondary/Supporting Standard: *Water Bars***

#### **MS-ESS3-3.**

**Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.** [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wet lands), and pollution (such as of the air, water, or land).]

**Targeted Standard: *Blue Bird Bungalows, Build a Civilization, Crunchy Crickets, Garbage Dissection, Gardening & Compost, Get a Half Life, Go Fly A Kite, Guerrilla Gardening, It All Flows Downhill, Leave No Trace, One In Harmony, Ring Around A Tree, Sand Castles, Sawmill Visit, Solar Power, Stream-Dam It, Trailblazing, Turtle Hurdles, Water Game, What's in Your Water, Wind Power, Wood Ducks, Worm City***

**Secondary/Supporting Standard: *Alternative Energy, The Appalachian Trail, ~Back to Basics, Bridge Over Troubled Water, Bridge That, Build It Your Way, Burma Bridge, Charles River, Chef Sun Beam, Coming Attractions, Concreate Structures, Dirty Water, Dominoes, ~Environmental Hearing, Gone Fishin', Hang In There, H2UOh, H2Whoa, Ice Cubes and Glaciers, Invasion of the Worms, Landscape Modeling, Mutant Moths, Oil Game, The Old Mill Stream, Pangea Mapping, Plastics SMASHtics, Plumping Mill, Potato Porcupines, Sam the Clam, Save the World, Shampoo Sham, Soil Is More Than Just Dirt, Timber, Up on the Watershed, We the People, Well Building***

#### **MS-ESS3-4.**

**Construct an argument supported by evidence for how increases in human population and per-capita**

**consumption of natural resources impact Earth's systems.** [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

**Targeted Standard:** *Crunchy Crickets, Edible Plants, H2UhOh, It all Flows Downhill, Medicinal Plants, Sam the Clam, Trailblazing, Up on the Watershed, Water Game, We the People*

**Secondary/Supporting Standard:** *Alternative Energy, ~Back to Basics, Bridge Over Troubled Water, Bridge That, Build a Civilization, Build It Your Way, Burma Bridge, Gone Fishin', H2Whoa, Hang In There, Oil Game, ~The Oregon Trail, Paper Making, Recycled Art, Sawmill Visit, Solar Energy, Trial of the Lorax, Watery Wonders, What's in Your Water, Wind Power*

#### **MS-ESS3-5.**

**Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

**Targeted Standard:** *Gasping for Air*

**Secondary/Supporting Standard:** *Dirty Water, For Crying Out Loud, H2UhOh, Ice Cubes and Glaciers, It all Flows Downhill, Oil Game, Plastic SMASHtics, Run For Your Lives, Swim For Your Lives, Thunderstorms*

### **MS-ETS1 Engineering Design**

#### **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.**

**Targeted Standard:** *Asteroids, Bridge Over Troubled Water, Bridge That, Build it Your Way, Egg Mobiles, Electric Motor, Electronics, Go Fly A Kite, Helicopters, How to Cross the Desert, ~Invention Convention, Making Electronics, Mousetrap Catapults, Scope It Out, Soda Can Steamboats, This Class Will Blow You Away, Wind Energy, Wind Power, You Light Up My Life*

**Secondary/Supporting Standard:** *Bernoulli and The Magical Puffer, Blast Off, Bounce, Build a Civilization, Burma Bridge, Eat Drink Sleep, Freaks of Nature, Hang in There, Hot Air Balloons, Martha Stewart's Chemical Rockets, Pendulum Principles, Sam the Clam, Tower of Power, Water Rockets*

#### **MS-ETS1-2.**

**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

**Targeted Standard:** *Rube Goldberg Machines,*

**Secondary/Supporting Standard:** *All Geared Up, Asteroids, Batmobiles, Digital Junk Dissection, ~Invention Convention, Look at 'Em Go, That's Shocking, Trebuchets and Catapults*

#### **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.

**Secondary/Supporting Standard: Bombs Away, Hang Gliders, Mentos Eruption**

**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.**

**Targeted Standard: Chef Sun Beam, Digital Junk Dissection**

**Secondary/Supporting Standard: Asteroids, Concrete Structures, Corny Little Explosions, Eat Sleep Drink, A Really, Really Bad Day, Sundials, Ups and Downs**