

Physical Science

Study of Matter PS.M

1 Classification of matter o Heterogeneous vs. homogeneous o Properties of matter o States of matter and its changes PS.M.1

Complexity a

- a1 Recognize the difference between a solution and mixture. PS.M.1A1
- a2 Classify objects by their physical properties (e.g., weight, melting and boiling points). PS.M.1A2
- a3 Describe how thermal energy moves (e.g., thermal energy as ice melts). PS.M.1A3

Complexity b

- b1 Identify a method to separate a mixture. PS.M.1B1
- b2 Describe physical properties of matter (e.g., size, weight, shape, magnetic, melting and boiling points). PS.M.1B2
- b3 Identify heat as thermal energy. PS.M.1B3

Complexity c

- c1 Create a mixture. PS.M.1C1
- c2 Identify a physical property of matter. PS.M.1C2
- c3 Identify heat as the cause of a phase change. PS.M.1C3

Learning Progression

- Recognize that substances combine in a variety of ways (mixtures versus solutions). PS.M.1.LP.A
- Identify substances that can be dissolved by water. PS.M.1.LP.B
- Group solids, liquids and gases. PS.M.1.LP.C
- Sort objects by a given physical property (e.g., size, shape, magnetic). PS.M.1.LP.D
- Separate a mixture PS.M.1.LP.E
- Create a mixture. PS.M.1.LP.F
- Manipulate various solids and liquids. PS.M.1.LP.G
- Identify hot and cold objects (heating and cooling). PS.M.1.LP.H
- Recognize that heat causes objects to change phase (e.g., watch ice melt). PS.M.1.LP.I

2 Atoms o Models of the atom (components) o Ions (cations and anions) o

Isotopes PS.M.2

Complexity a

- a Identify parts of an atom (protons, neutrons, electrons). PS.M.2A

Complexity b

- b Identify a diagram or model of an atom. PS.M.2B

Complexity c

- c Identify that all matter is made of atoms. PS.M.2C

Learning Progression

- Match the parts of the atom to the representative parts of a model. PS.M.2.LP.A
- Identify the parts of the atom. PS.M.2.LP.B
- Identify that an atom has different parts. PS.M.2.LP.C
- Observe or manipulate a model of an atom. PS.M.2.LP.D
- Recognize that the atom is the building block of all matter. PS.M.2.LP.E

3 Periodic trends of the elements o Periodic law o Representative groups PS.M.3

Complexity a

- a Use a Periodic Table to answer questions (e.g., number of outer electrons, groupings). PS.M.3A

Complexity b

- b Recognize that elements are organized on the Periodic Table by their properties, number of protons, and number of outer electrons. PS.M.3B

Complexity c

- c Identify an element(s) on the periodic table. PS.M.3C

Learning Progression

- Exam each square in the periodic table and identify points of information (atomic number, symbol, atomic mass). PS.M.3.LP.A
- Recognize that groups of elements have unique characteristics and reactivity (based on the number of valence electrons). PS.M.3.LP.B
- Identify a pattern of change as you read the Periodic Table. PS.M.3.LP.C
- Identify that each element in the Periodic Table is unique. PS.M.3.LP.D
- Observe the Periodic Table. PS.M.3.LP.E

4 PS.M.4 Bonding and compounds o Bonding (ionic and covalent) o

Nomenclature PS.M.4

Complexity a

- a Recognize that atoms can bond ionically or covalently. PS.M.4A

Complexity b

b Recognize that atoms can bond (interact). **PS.M.4B**

Complexity c

c Identify a chemical compound. **PS.M.4C**

Learning Progression

- Pair elements that can bond. **PS.M.4.LP.A**
- Recognize that atoms can share valence electrons (covalent bonding). **PS.M.4.LP.B**
- Recognize that atoms give or receive valence electrons (ionic bonding). **PS.M.4.LP.C**
- Identify what points of information on each square indicated how an element reacts. **PS.M.4.LP.D**
- Identify atoms that are typically non-reactive (based on position in the Periodic Table). **PS.M.4.LP.E**
- Identify groups of elements have similar properties and reactivity. **PS.M.4.LP.F**
- Observe the Periodic Table. **PS.M.4.LP.G**

Energy and Waves **PS.EW**

1 Conservation of energy o Quantifying kinetic energy o Quantifying gravitational potential energy **PS.EW.1**

Complexity a

a Describe the requirement(s) to change an object's energy from kinetic to potential (or potential to kinetic). **PS.EW.1A**

Complexity b

b When a given a situation, identify if the change in energy was to kinetic or potential energy. **PS.EW.1B**

Complexity c

c Identify a situation that demonstrates a change to the kinetic or the potential energy of an object. **PS.EW.1C**

Learning Progression

- Identify the energy transformations for an object in motion. **PS.EW.1.LP.A**
- Observe a series of pictures and identify the energy in use (sledding down a hill and the transformations of energy). **PS.EW.1.LP.B**
- Manipulate objects to demonstrate a change from potential to kinetic energy (slinky, spring, rubber band). **PS.EW.1.LP.C**
- Name types of energy (kinetic or potential). **PS.EW.1.LP.D**
- Observe how an object falls (lands solidly or bounces). **PS.EW.1.LP.E**
- Indentify why an object falls. **PS.EW.1.LP.F**
- Observe a falling object. **PS.EW.1.LP.G**

2 Transfer and transformation of energy (including work) PS.EW.2

Complexity a

- a** Describe how heat energy can be transferred (e.g., radiation, conduction, convection). PS.EW.2A

Complexity b

- b** Identify the transformation of energy in a given scenario (e.g., light bulb). PS.EW.2B

Complexity c

- c** Identify that energy can be transferred (e.g., electricity is transferred to light energy in a light bulb). PS.EW.2C

Learning Progression

- Investigate how various light intensities can heat an object (light bulb size, color, distance). PS.EW.2.LP.A
- Identify different ways to heat an object. (Use pictures to illustrate radiation, conduction and convection). PS.EW.2.LP.B
- Identify how different initiators have different transfers of energy on an object (e.g. ice cube hit with a hammer, exposed to a flame, pushed). PS.EW.2.LP.C
- Identify what initiates a transfer of energy. PS.EW.2.LP.D
- Observe various transfers of energy. PS.EW.2.LP.E

4 Thermal energy PS.EW.4

Complexity a

- a1** Describe how thermal energy moves from a warmer object to a cooler object. PS.EW.4A1
- a2** Describe how different colors of objects absorb thermal energy differently. PS.EW.4A2

Complexity b

- b1** Identify heat as thermal energy PS.EW.4B1
- b2** Explore how thermal energy can be absorbed by objects. PS.EW.4B2

Complexity c

- c1** Identify heat as the cause of a phase change. PS.EW.4C1
- c2** Follow the path of thermal energy transfer in a diagram. PS.EW.4C2

Learning Progression

- Identify patterns of heating in various objects (how hot it gets, time of exposure, types of materials). **PS.EW.4.LP.A**
- Match characteristics with heating patterns and everyday uses (e.g., insulator in a lunch box, pot holders, thermal cups). **PS.EW.4.LP.B**
- Recognize that thermal energy flows from warmer objects to cooler ones. **PS.EW.4.LP.C**
- Investigate that objects absorb heat differently (e.g., using a heat lamp, expose various objects to light for a given time and feel the temperature of the object). **PS.EW.4.LP.D**
- Identify the path of thermal energy transfer (e.g., a pot of water on a stove/hot plate). **PS.EW.4.LP.E**
- Observe a diagram displaying the transfer of energy. **PS.EW.4.LP.F**

Forces and Motion **PS.FM**

1 Motion o Introduction to one-dimensional vectors o Displacement, velocity (constant, average and instantaneous) and acceleration. o Interpreting position vs. time and velocity vs. time graphs **PS.FM.1**

Complexity a

- a** Describe the motion of an object given its placement on a graph (position vs. time graph). **PS.FM.1A**

Complexity b

- b** Identify the force (balanced or an unbalanced force) of a moving object. **PS.FM.1B**

Complexity c

- c** Apply an unbalanced force to an object to change its motion (e.g., accelerate it, stop it, start it). **PS.FM.1C**

Learning Progression

- Graph the motion of an object using paper, pencil and/or software programs. **PS.FM.1.LP.A**
- Match arrow direction with the direction of motion. **PS.FM.1.LP.B**
- Match arrow size to motion of an object (small with low speed, large with high speed) **PS.FM.1.LP.C**
- Identify what information can be given with arrow size and direction. **PS.FM.1.LP.D**
- Use arrows to represent the movement of an object. **PS.FM.1.LP.E**
- Indicate directionality of motion of an object (eye movement, pointing). **PS.FM.1.LP.F**
- Observe the motion of objects at different rates of speed. **PS.FM.1.LP.G**

2 Forces o Force diagrams o Types of forces (gravity, friction, normal, tension) o Field model for forces at a distance PS.FM.2

Complexity a

- a1 Create a force diagram by indicating the location and direction of the normal force. PS.FM.2A1
- a2 Organize the surface types from “causes the most friction” (most difficult to push) to “causes the least amount of friction” (easiest to push). PS.FM.2A2

Complexity b

- b1 Label forces and/or directions of forces on a force diagram. PS.FM.2B1
- b2 Investigate friction and normal force as it relates to moving an object (sliding furniture over different types of flooring). PS.FM.2B2

Complexity c

- c1 Identify a force on an object in a force diagram. PS.FM.2C1
- c2 Recognize that diverse surface types cause friction differently. PS.FM.2C2

Learning Progression

- Sequence surface types from “causes the most friction” to “causes the least amount of friction” PS.FM.2.LP.A
- Compare surface types by the amount of friction experienced by a moving object with the same force. PS.FM.2.LP.B
- Investigate patterns of motion on the various surfaces. PS.FM.2.LP.C
- Investigate the effect different surfaces have on an object (e.g., slide an object on different surfaces such as shag carpet, smooth carpet, wooden floor, ice). PS.FM.2.LP.D
- Observe what happens when sliding objects over various surfaces. PS.FM.2.LP.E

3 PS.FM.3 Dynamics (how forces affect motion) o Objects at rest o Objects moving with constant velocity o Accelerating objects PS.FM.3

Complexity a

- a Describe a motion of an object given its position vs. time graph. PS.FM.3A

Complexity b

- b Apply an unbalanced force to an object to change its motion (e.g., accelerate it, stop it, start it). PS.FM.3B

Complexity c

- c Identify an unbalanced force. PS.FM.3C

Learning Progression

- Match a visual of an object in motion with a position vs. time graph. **PS.FM.3.LP.A**
 - Demonstrate changing an object's motion by applying an unbalanced force (e.g., accelerate it, stop it, start it). **PS.FM.3.LP.B**
 - Recognize that adding and/or removing forces from an object causes it to change its motion. **PS.FM.3.LP.C**
 - Recognize that when forces are unbalanced motion changes. **PS.FM.3.LP.D**
 - Identify the force that is acting on an object to change its motion. **PS.FM.3.LP.E**
 - Observe objects in various states of motion (standing still, moving at a constant speed, circular motion, speeding up, slowing down). **PS.FM.3.LP.F**
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The Universe **U**

1 History of the universe **PS.U.1**

Complexity a

- a** Create a model that shows how the universe is expanding (e.g., blowing up a balloon). **PS.U.1A**

Complexity b

- b** Identify a model that illustrates the Big Bang theory. **PS.U.1B**

Complexity c

- c** Recognize that the universe is expanding. **PS.U.1C**

Learning Progression

- Demonstrate how the universe is expanding by creating a model. **PS.U.1.LP.A**
 - Recognize that celestial movement is outward (away from each other). **PS.U.1.LP.B**
 - Observe a model of our solar system moving within our galaxy. **PS.U.1.LP.C**
 - Identify our galaxy. **PS.U.1.LP.D**
 - Recognize that our solar system exists within a galaxy. **PS.U.1.LP.E**
 - Observe a model of our solar system in motion. **PS.U.1.LP.F**
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2 Galaxies **PS.U.2**

Complexity a

- a** Classify a galaxy based on its shape (e.g., spiral, barred-spiral, elliptical, irregular). **PS.U.2A**

Complexity b

- b** Match two galaxies of the same type (e.g., spiral, elliptical). **PS.U.2B**

Complexity c

- c** Recognize that many stars make up a galaxy. **PS.U.2C**

Learning Progression

- Use NASA data from a satellite, e.g., Hubble, to determine how long it takes to travel through our solar system. Using this time factor, think about how long it would take to travel to the nearest star. This helps to map out the size of the galaxy/universe. **PS.U.2.LP.A**
 - Identify that light years are huge distances. **PS.U.2.LP.B**
 - Know that behavior of light waves provides evidence for the motion of the universe (expanding). **PS.U.2.LP.C**
 - Recognize that stars are in motion and are light years away from each other. **PS.U.2.LP.D**
 - Create a list of celestial objects that will be found in a galaxy (e.g., sun , planets, moon, asteroid, galaxy). **PS.U.2.LP.E**
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3 Stars o Formation; stages of evolution o Fusion in stars **PS.U.3**

Complexity a

- a** Match a star of a specific relative mass (e.g., low, medium, high) with its life cycle. **PS.U.3A**

Complexity b

- b** Identify “mass” as the property that determines the life cycle of a star. **PS.U.3B**

Complexity c

- c** Recognize that stars form from clouds of gas. **PS.U.3C**

Learning Progression

- Recognize that stars have a life cycle and those stages have certain characteristics based on composition of gases. **PS.U.3.LP.A**
- Recognize that light provides evidence of motion. **PS.U.3.LP.B**
- Recognize that stars give off light because of chemical reactions of gases. **PS.U.3.LP.C**
- Recognize that our sun is a star in the galaxy/universe and that we see it in the daytime due to proximity. **PS.U.3.LP.D**
- Observe the night sky and recognize stars. **PS.U.3.LP.E**