Academic Alignment Standards

Exhibit Exploration Guide

Grade 6

Learning World Key
Energy Factory = EF
Grow U = GU
Upper Atrium = UA
Lower Atrium = LA
Idea Lab = IL

Ohio's Learning Standards for Science

6.ESS.4: Soil is unconsolidated material that contains organic matter and weathered rock. Soil formation occurs at different rates and is based on environmental conditions, types of existing bedrock and rates of weathering. Soil forms in layers known as horizons. Soil horizons can be distinguished from one another based on properties that can be measured. **GU**

6.ESS.5: Rocks, minerals and soils have common and practical uses. Nearly all manufactured material requires some kind of geologic resource. Most geologic resources are considered nonrenewable. Rocks, minerals and soil are examples of geologic resources that are nonrenewable. **EF**

6.PS.1: Matter is made up of small particles called atoms. Matter has mass, volume and density and is made up of particles called atoms. **UA**

6.PS.2: Changes of state are explained by a model of matter composed of particles that are in motion. Temperature is a measure of the average motion of the particles in a substance. Heat is a process of energy transfer rather than a type of energy. Energy transfer can result in a change in temperature or a phase change. When substances undergo changes of state, atoms change their motion and position. **UA**

6.PS.3: There are two categories of energy: kinetic and potential. Objects and substances in motion have kinetic energy. Objects and substances can have energy as a result of their position (potential energy). **EF, LA**

6.PS.4: An object's motion can be described by its speed and the direction in which it is moving. An object's position and speed can be measured and graphed as a function of time. **IL**

Common Core State Standards for Mathematics

6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. **IL**

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Answer Key

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Energy Factory

Info Glider

1. Answers will vary, including:
   - A pump can move up and down to create suction that draws out the oil.
   - A second hole can be drilled in the reservoir to inject steam which pushes the oil out.
2. Answers will vary, including:
   - Gasoline, diesel oil, kerosene, jet fuel, tar, wax, eyeglasses, combs, crayons, balloons, curlers, adhesives, dice, aspirin, soap, candles, boats, toothpaste, and shampoo.
3. Answers will vary, including:
   - Use less heat and air conditioning, turn electronics off when not in use, and use public transportation, rideshare, walk, or bike to get around.

Dominoes

1. Standing up
2. D

Upper Atrium

Hot Air Balloons

1. A
2. The hot air balloon comes back down because the molecules cool down and get closer together again, which increases their density.

Grow U

Water Drainage Wheel

1. Circle the sand, cross out the clay
2. Sand
3. Clay
4. Sample answer: If a soil has greater porosity, water will drain through it faster.
5. Clay

Soil Monoliths

1. Answers will vary based on the chosen monolith.
2. Descriptors may include rocky, sandy, rough, coarse, smooth, reddish brown, yellowish brown, or gray.

Lower Atrium

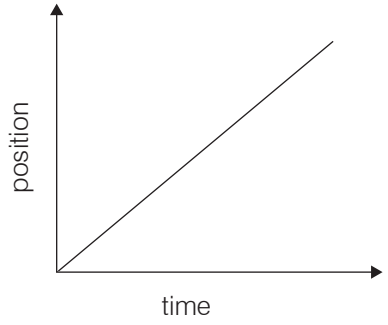
Tennis Ball Launcher

1. A
2. E
3. The tennis ball traveled both higher and faster the second time.
4. A greater amount of gravitational potential energy at the high point in the ball's path means the ball will move with more speed and have greater kinetic energy when it comes back down.

Idea Lab

Air Cars

1. 510 cm ÷ 3 seconds = 170 centimeters per second
2. a. Gizmo
2. b. Nelson
3. When the car stops, there is a horizontal line on the graph because the position isn't changing.
4. Answers will vary. Example:



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Student Data Recording

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Energy Factory

Info Glider (6.ESS.5)

Natural resources have to be extracted from the ground before they can be used. Use the info glider to learn how oil is extracted.

1. Describe one process used to extract oil from the ground

2. List three practical ways petroleum products can be used:

_____

_____

_____

3. What is one way you can reduce energy usage to conserve nonrenewable energy resources? Write or draw a picture.

Dominoes (6.PS.3)

Build a line or pattern with the dominoes and then knock one over to start a chain reaction. Think about the dominoes in different positions.

1. Which domino has more energy that can be transferred to another domino, one that is standing up or one that is already lying down flat?

2. Look at the picture below. Which domino has the most potential energy, based on its position? (Choose A, B, C or D)

A B C D

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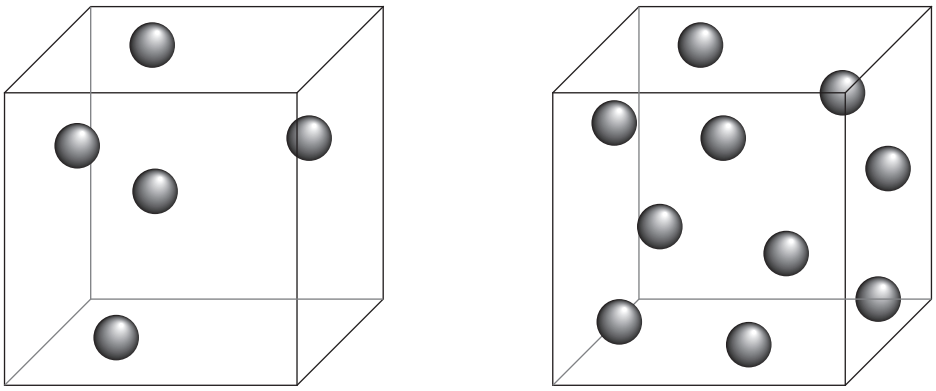
Upper Atrium

Hot Air Balloons (6.PS.1, 6.PS.2)

Hold the red button to heat the air (which is a gas) inside of the balloon. As thermal energy gets transferred to the air inside the balloon, the air molecules vibrate more and spread out.

1. Which image in the diagram below represents the air in the balloon **after** the air has been heated up? (Circle A or B)



A B

2. The warm air rises because it is less dense than the cool air around it. Why does the balloon come back down after a few moments?

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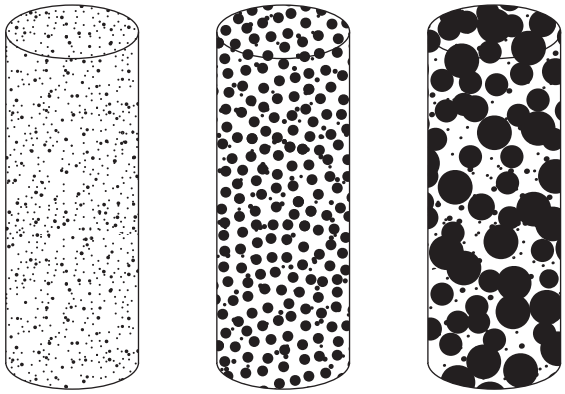
Grow U

Water Drainage (6.ESS.4)

1. Different kinds of soils have different properties. One property is porosity, or the amount of space in between soil particles. **Look** at the drawing below and **compare** it with the Water Drainage exhibit. Then **circle** the particle type with the greatest porosity (most space in between particles) and **cross out** the particle type with the least porosity (least space between particles).



Clay Silt Sand

2. **Turn** the Water Drainage wheel and circle which type of soil particle lets the water drain through it **most quickly**:

Sand **Silt** **Clay**

3. **Circle** which type of soil particle lets the water drain through it the **most slowly**:

Sand **Silt** **Clay**

4. How is porosity related to the rate of water drainage?

5. Based on the observations you recorded above, which soil particle type would be the best for building a pond, where you want to trap water and keep it from draining out?

Sand **Silt** **Clay**

Soil Monoliths (6.ESS.4)

1.Look at the soil monoliths and choose one. Circle the name of the monolith you chose:

Fulton Ottokee Tedrow Latty

Write 3 words that describe the soil monolith you chose:

_____

_____

_____

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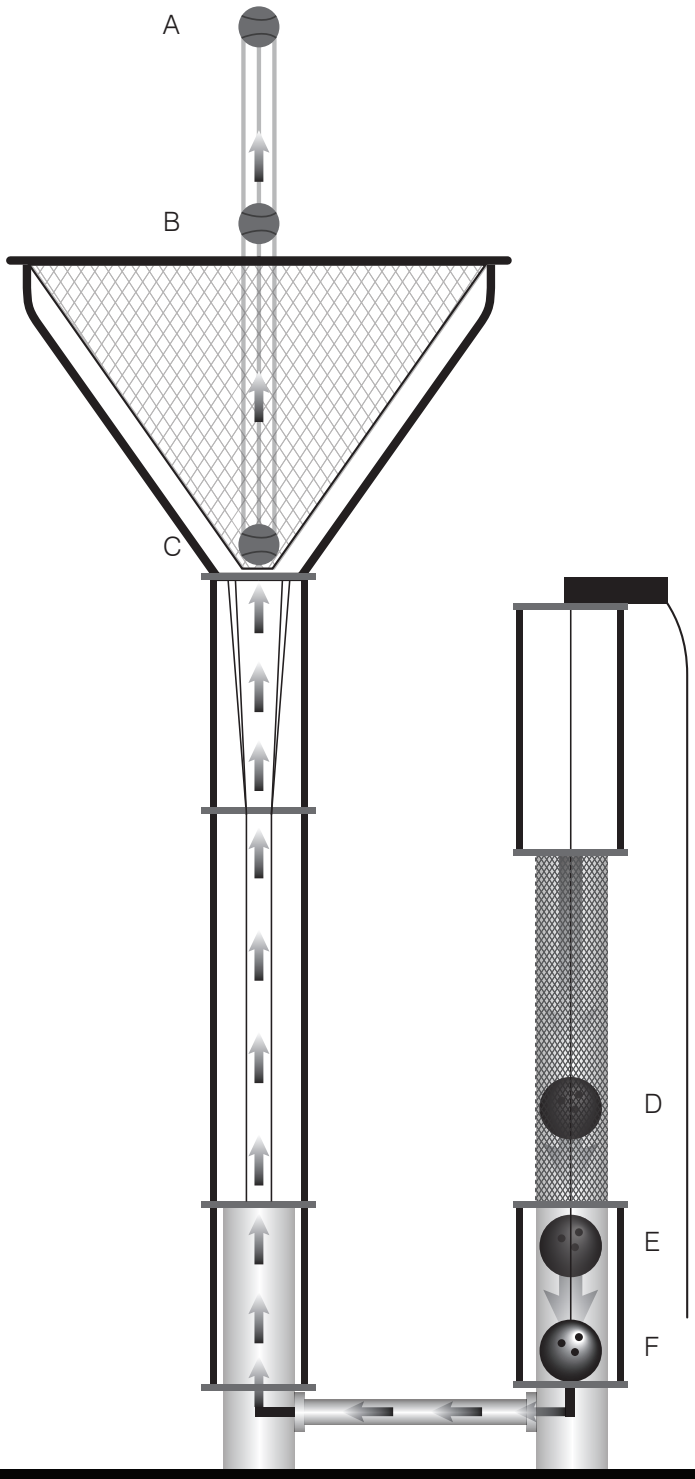
Lower Atrium

Tennis Ball Launcher (6.PS.3)

Pull on the rope to lift the bowling ball, then let go of the rope to launch the tennis ball in the air. Use the diagram to help you answer the questions.



1. At which position does the **tennis ball** have the most gravitational potential energy?

   Choose A B C

2. Objects in motion have kinetic energy. After you let go of the rope, at what position does the bowling ball have the most kinetic energy and is moving the fastest?

   Choose D E F

3. First, raise the bowling ball to the **bottom** of the metal screen and release it. Look how high the tennis ball goes. Next, raise the bowling ball to the **top** of the metal screen and release it. Look how high the tennis ball goes.

   Which time did the tennis ball travel **higher**?

   Which time did the tennis ball travel **faster**?

4. How does the amount of **gravitational potential energy** the tennis ball has at its peak impact how much **kinetic energy** the tennis ball has when it comes back down?

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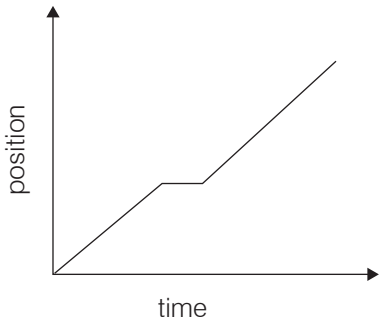
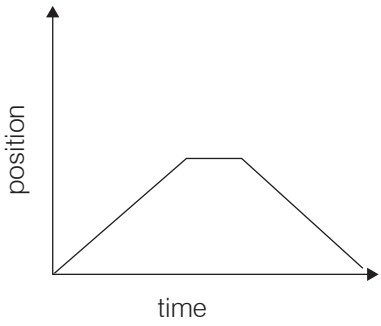
Idea Lab

Air Cars (6.PS.4 and 6.RP.3)
Build an air powered car, charge it up with compressed air, and launch it down the track!

1. Speed is calculated by dividing distance by time. If it takes a car 3 seconds to travel the distance of 510 centimeters down the track, what is the car's average speed in centimeters per second?

2. Look at the position vs time graphs below, and match them to the scenario.
   - Gizmo launched an air car down the track. The car came to a stop in the middle of the track, so Gizmo gave the air car another push until it made it to the end of the track.
   - Nelson also launched an air car down the track. Nelson's car came to a stop in the middle of the track. Nelson gave it a push to send it back to the beginning of the track to try again.



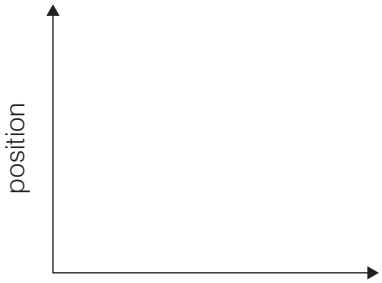


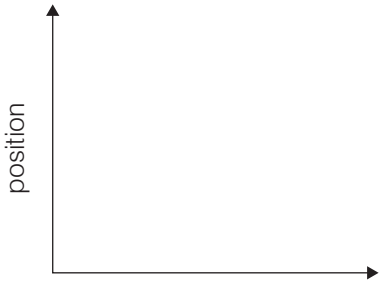
a. Gizmo or Nelson (circle one)

b. Gizmo or Nelson (circle one)

3. What do the position vs time graphs look like at the point when the cars come to a stop?

4. Graph how your air car travels! Try comparing how your car moves when it's half charged with air compared to when it's fully charged with air.





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