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UNIT NARRATIVE

This unit will focus not only on force and motion but also on scientific practices. Students will be conducting numerous investigations to in this unit to figure out the content versus being told the content. The emphasis is on gaining a conceptual understanding the fundamentals of forces and introducing Newton’s 3rd law. The unit will begin with the students designing a balloon car racer. This racer will be used as the introductory phenomenon for the unit. Students will then explore forces through various investigations. In each investigation, students will figure out the factors that effect that particular force.

CONTENT STANDARDS

Below are the standards **taught** and **assessed** in this unit.

Readiness Standards

- 6.7A identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces using real-world applications;
- 6.7B calculate the net force on an object in a horizontal or vertical direction using diagrams and determine if the forces are balanced or unbalanced; and
- 6.7C identify simultaneous force pairs that are equal in magnitude and opposite in direction that result from the interactions between objects using Newton's Third Law of motion.
- 6.8A compare and contrast kinetic energy with gravitational, elastic, and ~~chemical~~ potential energies;
- 6.8B describe how energy is conserved through transfers and transformations in systems such as ~~electrical circuits, food webs,~~ amusement park rides, and ~~photosynthesis~~
- 6.8C explain how energy is transferred through transverse and longitudinal waves

UNDERSTANDINGS AND QUESTIONS

Important big ideas and processes for the unit.

Key Understandings

- A force is a push or a pull acting between two objects.
- The size/strength of the magnet, the distance between the magnet and object, and the material of the object can all affect magnetic force.
- Magnetic forces are at-a-distance forces. The size/strength of the magnet, the distance between the magnet and object, and the material of the object can all affect magnetic force.
- Spring forces are contact forces. The mass of the object placed on the spring and the number of coils affect the elastic potential energy of the spring. The elastic potential energy can be measured when it is converted to kinetic energy.
- Frictional forces are contact forces that oppose motion. Frictional forces are affected by the surface of the object and the surface the object is sliding on and the shape of the object.

A force is described by its strength and direction.

If two forces are balanced and there is no change in motion, position, or direction.

A net force of zero causes no change in motion

Key Questions

How does the mass of an object placed on a spring affect the elastic potential energy of the spring? How do the number of coils or the size of a spring affect the elastic potential energy of the spring? How can the elastic potential energy be determined or measured?

In what ways do unbalanced forces affect the motion of an object?

Why can an object with balanced forces still be in motion? Justify with examples.

In what ways are kinetic and potential energy related to force and motion? Justify with examples.

ROADMAP

Daily guide for instruction in this unit.

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Lesson 01: Balloon Car Racers Day 1	<p>SWBAT use science practices to design and test a balloon car racer.</p> <p>TEKS 6.7C identify simultaneous force pairs that are equal in magnitude and opposite in direction that result from the interactions between objects using Newton’s Third Law of motion.</p> <p>6.1B use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;</p>	<p>The balloon car racer is the anchoring event that will launch this unit and is an example of Newton’s Third Law of Motion. It will be referred to at the end of the unit and students will label the forces that were acting upon the car and how these forces changed the motion of the car.</p> <ul style="list-style-type: none"> • Students will design a balloon racer that they will enter into a competition to test whose balloon car goes the farthest. • Students will design and redesign their racers. <p><u>Vocabulary</u> Constants Dependent Variable Independent Variable IVCDV Chart</p>	Lesson 01: Balloon Car Racers Day 1
Lesson 02: Balloon Car Racers Day 2	<p>SWBAT use science practices to design and test a balloon car racer.</p> <p>TEKS 6.7C identify simultaneous force pairs that are equal in magnitude and opposite in direction that result from the interactions between objects using Newton’s Third Law of motion.</p> <p>6.1B use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;</p>	<ul style="list-style-type: none"> • Students will complete the redesign of their racers. • Students will test their racers and collect data. • Students will graph the data for the distance their racer traveled. • Students will describe what variable they think will have the greatest effect on how far the racers went. Students will explain how the races moved and what powered the racers. Students will draw a model to go with their explanations <p><u>Vocabulary</u> Constants Dependent Variable Independent Variable IVCDV Chart</p>	Lesson 02: Balloon Car Racers Day 2

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Lesson 03: What is Motion? What is Force? Day 1	<p>SWBAT explore how forces act upon objects to cause motion</p> <p>TEKS 6.7A identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces using real-world applications;</p>	<p>Use the Balloon lab to move into a discussion of motion and force.</p> <p>In this first day of the lesson, students will rotate through station labs to learn about different types of forces.</p> <p>The physics of motion is all about forces. Forces need to act upon an object to get it moving, or to change its motion.</p>	Lesson 03: What is Motion? What is Force? Day 1
Lesson 04: What is Motion? What is Force? Day 2	<p>SWBAT explore how forces act upon objects to cause motion</p> <p>TEKS 6.7A identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces using real-world applications;</p>	<p>On day 2, students will complete a reading to learn to solidify the concepts they experienced in the lab.</p> <p><u>Vocabulary</u> Action at a Distance Applied Force Contact Force Force Frictional Force Gravitational Force Magnetic Force Motion Normal Force Spring Force</p>	Lesson 04: What is Motion? What is Force? Day 2

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Lesson 05: Magnetic Force	<p>SWBAT use science practices to design an investigation to explain how magnetic forces act on objects</p> <p>TEKS 6.7A identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces using real-world applications;</p> <p>6.1B use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;</p>	<p>Students will use magnets to design an investigation to explain how magnetic forces act on objects.</p> <p>Magnetic forces are at-a-distance forces. The size/strength of the magnet, the distance between the magnet and object, and the material of the object can all affect magnetic force.</p> <p><u>Vocabulary</u> Attractive force Magnetism Magnetic field Magnetic Pole Repelling force</p>	Lesson 05: Magnetic Forces
Lesson 06: Spring Force	<p>SWBAT use science practices to design an investigation to explain how spring forces act on objects</p> <p>TEKS 6.7A identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces using real-world applications;</p> <p>6.1B use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;</p>	<p>Students will use springs to design an investigation to explain how spring forces act upon objects.</p> <ul style="list-style-type: none"> • Students will identify where springs are used in everyday life. • Students will design an investigation to determine the relationships between variables. • Students will conduct the investigations they designed. • Students will be able to explain how mass and number of coils in a spring affect the elastic potential energy of the spring. <p>Spring forces are contact forces. The mass of the object placed on the spring and the number of coils affects the elastic potential energy of the spring. The elastic potential energy can be measured when it is converted to kinetic energy.</p> <p><u>Vocabulary</u> Coil Elastic potential energy Spring Force</p>	Lesson 06: Spring Force

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Lesson 07: Frictional Force	<p>SWBAT use science practices to design an investigation to explain how frictional forces act on objects</p> <p>TEKS 6.7A identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces using real-world applications;</p> <p>6.1B use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;</p>	<p>Students will design an investigation to explain how frictional forces affect objects.</p> <ul style="list-style-type: none"> • Students will define frictional force, static friction, and kinetic friction. • Students will design an investigation to determine the relationships between variables and friction. • Students will conduct the investigations they designed. • Students will be able to explain how friction affects how objects move. <p>Frictional forces are contact forces that oppose motion. Frictional forces are affected by the surface of the object and the surface the object is sliding on and the shape of the object.</p> <p><u>Vocabulary</u> Frictional Force Kinetic Friction Normal Force Static Friction</p>	Lesson 07: Frictional Forces

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Lesson 08: Balanced and Unbalanced Forces	<p>SWBAT use diagrams to determine if forces are balanced or unbalanced and calculate the net force of an object.</p> <p>TEKS 6.7B calculate the net force on an object in a horizontal or vertical direction using diagrams and determine if the forces are balanced or unbalanced; and</p>	<ul style="list-style-type: none"> • Students will participate in a demonstration where they experience balanced and unbalanced forces. • Students will play a net force football board game in which they will practice calculating net force. • Students will complete a net force practice sheet where they will calculate the net for given objects and scenarios. <p>Key Understandings:</p> <ul style="list-style-type: none"> • An unbalanced force occurs when one force on an object is greater than other forces on the same object. • Unbalanced forces can cause an object to change direction or position. • If opposing forces acting on an object cancel each other out, the force is considered balanced and there is no change in position or direction. When more than one force acts on an object, the forces combine to form a net force. The combination of all the forces acting on an object is the net force. • When two forces act in the same direction on an object, the net force is equal to the sum of the two forces. • When two unequal forces act in opposite directions on an object, the net force is the difference between the two forces. <p><u>Vocabulary</u> Action Force Net Force Newton’s Third Law Reaction Force Unbalanced Force</p>	Lesson 08: Balanced and Unbalanced Forces

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Lesson 09: Gravitational Potential Energy and Position Day 1	<p>SWBAT use science practices to design an investigation to explain how the position of an object effects its gravitational potential energy.</p> <p>TEKS 6.8A compare and contrast kinetic energy with gravitational, elastic, and chemical potential energies;</p>	<p>Students will design an investigation to determine how the position of an object effects the object gravitation potential energy.</p> <p>Gravitational potential energy is the energy stored in an object as the result of its vertical position or height. The energy is stored as the result of the gravitational attraction of the Earth for the object. The greater the height, the greater the gravitational potential energy.</p> <p><u>Vocabulary</u> Gravitational Potential Energy Kinetic energy</p>	Lesson 09: Gravitational Potential Energy and Position Day 1
Lesson 10: Gravitational Potential Energy and Position Day 2	<p>SWBAT use science practices to design an investigation to explain how the position of an object effects its gravitational potential energy.</p> <p>TEKS 6.8A compare and contrast kinetic energy with gravitational, elastic, and chemical potential energies;</p>	<p>Students will design an investigation to determine how the position of an object effects the object gravitation potential energy.</p> <p>Gravitational potential energy is the energy stored in an object as the result of its vertical position or height. The energy is stored as the result of the gravitational attraction of the Earth for the object. The greater the height, the greater the gravitational potential energy.</p> <p><u>Vocabulary</u> Gravitational Potential Energy Kinetic energy</p>	Lesson 10: Gravitational Potential Energy and Position Day 2

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Lesson 11: Gravitational Potential Energy and Mass	<p>SWBAT use science practices to design an investigation to explain how the mass of an object affects its gravitational potential energy.</p> <p>TEKS 6.8A compare and contrast kinetic energy with gravitational, elastic, and chemical potential energies;</p>	<p>Students will design an investigation to determine how the mass of an object affects the object's gravitation potential energy.</p> <p>The greater the mass of an object, the greater the gravitational potential energy.</p>	Lesson 11: Gravitational Potential Energy and Mass
Lesson 12: Elastic Potential Energy	<p>SWBAT use science practices to design an investigation to explain the relationship between elastic potential energy and kinetic energy.</p> <p>TEKS 6.8A compare and contrast kinetic energy with gravitational, elastic, and chemical potential energies;</p>	<p>Students will design an investigation to determine what factors affect elastic potential energy.</p> <p>Elastic potential energy is potential energy stored because of the deformation of an elastic object, such as the stretching of a spring.</p> <p><u>Vocabulary</u> Elastic Potential Energy</p>	Lesson 12: Elastic Potential Energy
1 Flex Day	Review/Catch Up/Reteach Use these data as needed		
Unit Exam	TX_SCI_6thScience_S25_UE4		

UNPACKED STANDARDS

Focus standards for this unit.

Standards Clarification		
Standards	Specificity	Notes/Explanations/Examples
6.7A identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces using real-world applications;	Cognition: identify and explain Content: forces acting up objects Including, but not limited to: <ul style="list-style-type: none"> • Contact forces: <ul style="list-style-type: none"> □ Friction □ Applied Forces □ Normal Forces • Noncontact forces <ul style="list-style-type: none"> □ Gravity □ Magnetism 	In 5 th grade, students will investigate how force effects objects.
6.7B calculate the net force on an object in a horizontal or vertical direction using diagrams and determine if the forces are balanced or unbalanced; and	Cognition: calculate Content: net force, balanced, and unbalanced forces Including, but not limited to: <ul style="list-style-type: none"> • Forces with magnitudes in same directions • Forces with magnitudes if opposite directions 	
6.7C identify simultaneous force pairs that are equal in magnitude and opposite in direction that result from the interactions between objects using Newton’s Third Law of motion.	Cognition: identify Content: force pairs Including, but not limited to: <ul style="list-style-type: none"> • Equal magnitude • Opposite reactions 	
6.8A compare and contrast kinetic energy with gravitational, elastic, and chemical potential energies;	Cognition: compare and contrast Content: kinetic energy and potential energy Including, but not limited to: <ul style="list-style-type: none"> • Potential energy – stored energy of an object because of its position or shape <ul style="list-style-type: none"> ○ Gravitational- energy that is stored in an object due to it’s position ○ Elastic- energy stored as a result of deformation of an elastic object, such as the stretching of a spring ○ Chemical- -he energy stored in the chemical bonds of a substance • Kinetic energy – energy of motion 	STAAR: <ul style="list-style-type: none"> • This is the first-time students have been introduced to potential and kinetic energy. • Students should be able to identify examples of kinetic and potential energy. • Students may be assessed on points of greatest and least PE or KE in relationship to one another within the same system. • This concept is not explicitly taught again before the STAAR assessment in Grade 8. TxCCRS: VIII. Physics – D1 – Understand potential and kinetic energy. VIII. Physics – D2 – Understand conservation of energy
6.8B describe how energy is conserved through transfers and transformations in systems such as	Cognition: describe Content: energy transformations and conservation Including, but not limited to: <ul style="list-style-type: none"> ○ Chemical 	

Standards Clarification

Standards	Specificity	Notes/Explanations/Examples
electrical circuits, food webs, amusement park rides, and photosynthesis	<ul style="list-style-type: none"> ○ Thermal ○ Light (radiant) ○ Mechanical ○ Electrical • Example of energy transfers and transformation <ul style="list-style-type: none"> ○ Energy is transformed from radiant energy to chemical energy during photosynthesis. During cellular respiration, the chemical potential energy is transformed into other forms such as mechanical and thermal. ○ Food webs show how nutrients and energy pass as one organism eats another. • Law of conservation of energy <ul style="list-style-type: none"> ○ Energy can neither be created nor destroyed; it just changes form ○ When energy transfers between trophic levels, 10% of the energy is made available for the next level. <p>When a consumer eats a plant, energy is transferred from the plant to the consumer. That energy is used for growth, reproduction, and other biological processes. Some of that energy is transferred to thermal energy and released.</p>	

VERTICAL STANDARDS

This section details the **progression** of key student expectations/standards** in the courses **before** and **after** this course. This will help you understand what **prior knowledge skills to build upon** and guide you in knowing what **skills you are preparing your students** for in the subsequent course.

5 th Grade	6 th Grade	Grades Above
5.7B design a simple experimental investigation that tests the effect of force on an object in a system such as a car on a ramp or a balloon rocket on a string.	6.7A identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces using real-world applications;	7.7D analyze the effect of balanced and unbalanced forces on the state of motion of an object using Newton’s First Law of motion. 8.7A calculate and analyze how the acceleration of an object is dependent upon the net force acting on the object and the mass of the object using Newton’s Second Law of motion

<p>5.7A investigate and explain how equal and unequal forces acting on an object cause patterns of motion and transfer of energy; and</p>	<p>6.7B calculate the net force on an object in a horizontal or vertical direction using diagrams and determine if the forces are balanced or unbalanced; and</p>	<p>7.7A calculate average speed using distance and time measurements from investigations; 7.7B distinguish between speed and velocity in linear motion in terms of distance, displacement, and direction;</p>
	<p>6.7C identify simultaneous force pairs that are equal in magnitude and opposite in direction that result from the interactions between objects using Newton's Third Law of motion.</p>	<p>8.7B investigate and describe how Newton's three laws of motion act simultaneously within systems such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.</p>
<p>5.8C demonstrate and explain how light travels in a straight line and can be reflected and refracted.</p>	<p>6.8A compare and contrast kinetic energy with gravitational, elastic, and chemical potential energies;</p>	<p>7.8C explain the relationship between temperature and the kinetic energy of the molecules within a substance. 8.8A compare the characteristics of amplitude, frequency, and wavelength in transverse waves, including the electromagnetic spectrum;</p>
	<p>6.8B describe how energy is conserved through transfers and transformations in systems such as electrical circuits, food webs, amusement park rides, and photosynthesis</p>	<p>8.8B explain the use of electromagnetic waves in applications such as radiation therapy, wireless technologies, fiber optics, microwaves, ultraviolet sterilization, astronomical observations, and X-rays.</p>

VOCABULARY GLOSSARY

Domain-specific words and definitions for this unit.

Key Content Vocabulary

Action at A Distance: the concept that an object can be moved, changed, or otherwise affected without being physically touched by another object.

Action Force: a force that is applied to an object by an action.

Attractive force: the force by which one object attracts another

Applied Force: a force that is applied to an object by a person or another object

Coil: a length of something wound or arranged in a spiral or sequence of rings.

Constants: All factors that are held the same in order to create a “fair test” experiment. Also known as the controlled variables.

Contact Force: any force that requires contact to occur.

Dependent Variable: the variable being tested and measured in an experiment and is 'dependent' on the independent variable.

Elastic potential energy: energy stored because of applying a force to deform an elastic object.

Force: a push or a pull.

Frictional Force: the force that resists motion when the surface of one object comes in contact with the surface of another.

Gravitational force: the force of attraction between all masses in the universe

Gravitational Potential Energy: the energy stored in an object as the result of its vertical position or height.

Independent Variable: the variable the experimenter manipulates or changes and is assumed to have a direct effect on the dependent variable.

IVCDV Chart: Independent Variable, Constant, Dependent Variable chart. A graphic organizer to help you identify the parts of an investigation

Kinetic energy: the energy of motion, observable as the movement of an object, particle, or set of particles.

Kinetic Friction: a force that acts between moving surfaces

Magnetic Force: the force that exists between two magnets, caused by the interaction of their magnetic fields.

Magnetic field: a region of space near a magnet in which a magnetic force acts on any other magnet or magnetic object

Magnetic Pole: region at each end of a magnet where the external magnetic field is strongest

Magnetism: the force of attraction or repulsion between substances made of certain materials, such as iron, nickel, cobalt, and steel

Motion: an act or process of changing place or position

Net Force: the combination of all the forces that act on an object.

Newton’s Third Law – a law that states that for every action (force) in nature there is an equal and opposite reaction. If you push on a wall, the wall pushes back with the same force.

Normal Force: is the support force exerted upon an object that is in contact with another stable object

Reaction Force - a force that acts in the opposite direction to an action force

Repelling force: the force by which two objects repel or push away from each other

Spring Force: the force exerted by a compressed or stretched spring upon any object that is attached to it.

Static Friction: friction between two or more solid objects that are not moving relative to each other

Unbalanced Force - a force that causes a change in an object's state of motion

Consumable Materials and Lab Supplies for Unit 1 (1 per group of 4 students unless noted)

Lesson	Commercial Vendor	Lab Supplies Science Vendor
Lesson 01: Balloon Car Racers: Day 1	<ul style="list-style-type: none"> • 1 balloon (9-inch or smaller) • 1 flexible (bendy) straw • 1 straight straw cut in half • 1 wooden tongue depressor or jumbo craft stick • Tape 	
Lesson 02: Balloon Car Racers: Day 2	Painter's Tape	Meter Sticks or Measuring Tapes
Lesson 03: What is Force? What is Motion? Day 1	<p><u>Station 2:</u> 5 marbles of the same size</p> <p><u>Station 3:</u> Ping Pong Ball</p> <p><u>Station 4:</u> 2 rubber bands Painter's tape</p> <p><u>Station 5:</u> 3 ring magnets 1 metal paper clip</p> <p><u>Station 6:</u> Ping Pong ball Pencil Smooth Surface (table) Sandpaper or fuzzy type cloth Painter's tape</p> <p><u>Station 7:</u> Small piece of clay Spring Pom Pom Ball</p> <p><u>Station 8:</u> Rubber band Pom Pom Ball</p>	<p><u>Station 1:</u> Spring Scale Ring Stand Mass Weights (100g, 200g, 500g)</p> <p><u>Station 2:</u> Ruler with a groove in the center</p> <p><u>Station 3:</u> Meter Stick</p> <p><u>Station 4:</u> 2 spring scales</p> <p><u>Station 5:</u> Ruler</p> <p><u>Station 6:</u> Ruler</p> <p><u>Station 7:</u> Ruler</p> <p><u>Station 8:</u> 2 rulers</p>

Lesson 04: What is Force? What is Motion? Day 2	The teacher will use lab stations from Lesson 3 to model as the students read.	
Lesson 05: Magnetic Force	<p><u>Group A: (2 groups)</u></p> <ul style="list-style-type: none"> • 1 ring magnets • Magnetic objects such as: <ul style="list-style-type: none"> ○ 1 other magnet (must have) ○ Paper clip ○ tack ○ nail • Nonmagnetic objects such as: <ul style="list-style-type: none"> ○ eraser ○ wooden bead ○ craft stick ○ plastic counting bear <p><u>Group B: (2 Groups)</u></p> <ul style="list-style-type: none"> • 2 ring magnets <p><u>Group C: (2 groups)</u></p> <ul style="list-style-type: none"> • Magnet • Magnetic objects such as: <ul style="list-style-type: none"> ○ Paper clip ○ Tack ○ nail 	<p><u>Group A:</u></p> <ul style="list-style-type: none"> • Ruler <p><u>Group B:</u></p> <ul style="list-style-type: none"> • Ruler <p><u>Group C:</u></p> <ul style="list-style-type: none"> • Ruler
Lesson 6: Spring Force	<p><u>Group A</u></p> <ul style="list-style-type: none"> • Heavy dowel • 2 identical springs (use springs from lesson 3) <p><u>Group B</u></p> <ul style="list-style-type: none"> • Heavy dowel • At least two springs with different amounts of coils or different thicknesses of materials making up the coils. (Use set from lesson 03) 	<p><u>Group A</u></p> <ul style="list-style-type: none"> • Ruler • Ring stand with clamp • 4 hanging mass weights • Stopwatch <p><u>Group B</u></p> <ul style="list-style-type: none"> • Ruler • Ring stand with clamp • hanging mass weight • Stopwatch
Lesson 7: Frictional Force	<p><u>Group A</u></p> <ul style="list-style-type: none"> • Block of wood with hook attached 	<p><u>Group A</u></p> <ul style="list-style-type: none"> • Spring scale 20N

	<ul style="list-style-type: none"> • Book (to add weight to block) • Surface to pull across such as <ul style="list-style-type: none"> ○ Bubble wrap ○ Carpet ○ Sandpaper ○ Foil ○ Wax paper ○ Wooden plank <p><u>Group B</u></p> <ul style="list-style-type: none"> • Block of wood with hook attached • 4 identical books <p><u>Group C</u></p> <ul style="list-style-type: none"> • Block of wood with hook attached • 2 identical books 	<p><u>Group B</u></p> <ul style="list-style-type: none"> • Spring scale 20N • <p><u>Group C</u></p> <ul style="list-style-type: none"> • Spring scale 20N
Lesson 8: Balanced and Unbalanced Forces	<ul style="list-style-type: none"> • Dice 	
Lesson 9: Gravitational Potential Energy and Position (Roller Coaster Design) Day 1	<ul style="list-style-type: none"> • 2-meter (6 foot) long foam tube (1/2" pipe insulation) cut in half lengthwise • marble • paper or plastic cup • roll of masking tape • You can allow students other materials such as straws, craft sticks etc if you wish. 	
Lesson 10: Gravitational Potential Energy and Position (Roller Coaster Design) Day 2	Same as Day 1	
Lesson 11: Gravitation Potential Energy and Mass	<ul style="list-style-type: none"> • Ramp- flat piece of wood, cardboard or plastic • Three balls of varying mass such as a golf ball, ping pong ball, tennis ball, soccer ball, etc. • Books to elevate the ramp • Plastic bottle filled with a small amount of water or sand • Masking tape 	<ul style="list-style-type: none"> • Ruler or meter stick • Balance
Lesson 12: Elastic Potential Energy	<ul style="list-style-type: none"> • 2 paper, Styrofoam or plastic cups with lids • Duct tape 	<ul style="list-style-type: none"> • Scissors • Meter Stick

	<ul style="list-style-type: none">• Stick such as straw, disposable chopstick, wooden dowel, skewer, etc.• 3-4 Rubber bands• Paper clip• Plastic beads• Penny• Washer	
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