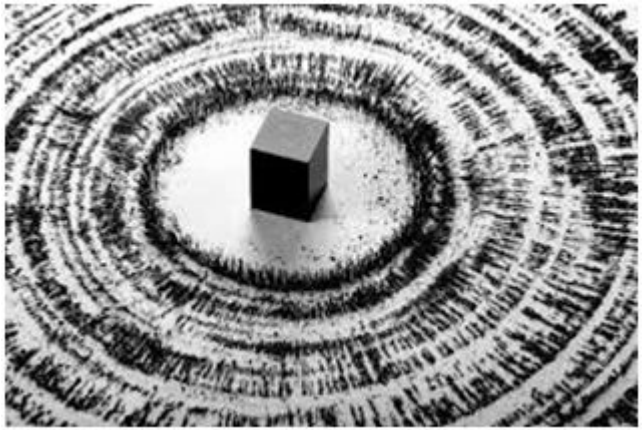
3rd Grade Unit 1
9 weeks

Forces and Interactions



Unit Planning Team:
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Dawn Buchanan (WS/BV), Brooke Bradley (LW/JD)

Essential Questions

How do equal and unequal forces on an object affect the object?

How can magnets be used?

How can we explain and predict interactions between objects?

Forces and Interactions

Students who demonstrate understanding can:

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.** [AR Clarification Statement: Examples could include an unbalanced force on one side of a box can make it start moving or 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.]

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.]

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 or 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 paperclips, 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 or 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.]

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.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1)
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)

Connections to Nature of Science

Science Knowledge is Based on Empirical Evidence

- Science findings are based on recognizing patterns. (3-PS2-2)

Scientific Investigations Use a Variety of Methods

Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)

Disciplinary Core Ideas

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)
- Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3, 3-PS2-4)

Crosscutting Concepts

Patterns

- Patterns of change can be used to make predictions. (3-PS2-2)

Cause and Effect

- Cause and effect relationships are routinely identified. (3-PS2-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4)

Forces and Interactions

Background knowledge videos:

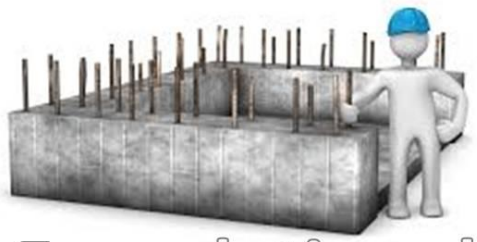
PS2A - Forces and Motion

PS2B - Types of Interactions

These videos are designed to assist in providing background knowledge with the associated DCI. The information in the videos follows the progression through high school.

Prior to 3rd grade, students should have knowledge, understanding of, and experiences with the following ideas:

- ★ Objects pull or push each other when they collide or are connected.
- ★ When objects touch or collide, they push on one another and can change motion or shape.
- ★ Pushes and pulls can have different strengths and directions.
- ★ Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
- ★ A bigger push or pull makes things speed up or slow down more quickly.
- ★ An object sliding on a surface or sitting on a slope experiences a pull due to friction.



Foundational Knowledge

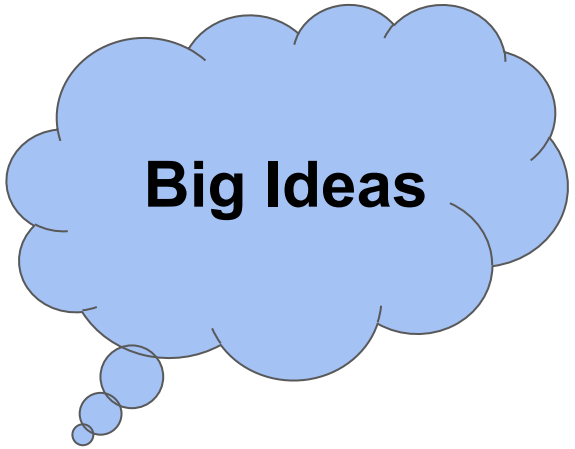
With the implementation of new standards, students may not have had opportunities to engage in these foundational understandings and ideas before 3rd grade. You may need to provide opportunities for students to experience these ideas as you move forward.

EQ's:

How do equal and unequal forces on an object affect the object?

How can magnets be used?

How can we explain and predict interactions between objects?



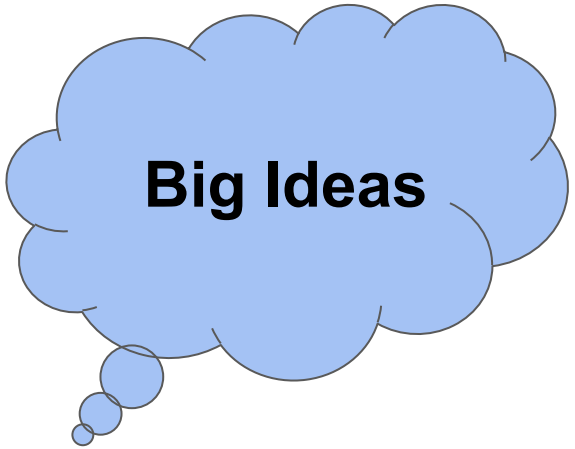
- ★ Effects of balanced and unbalanced forces on the motion of an object.
- ★ Each force acts on one particular object and has both strength and direction.
- ★ An object at rest typically has multiple forces acting on it. The forces add to give zero net force on the object.
- ★ Forces that do not sum to zero can cause changes in the object's speed or direction of motion.

EQ's:

How do equal and unequal forces on an object affect the object?

How can magnets be used?

How can we explain and predict interactions between objects?



★ The patterns of an object's motion in various situations can be observed and measured. When the past motion exhibits a regular pattern, future motion can be predicted from it.

★ Objects in contact exert forces on each other.

★ Electric and magnetic forces between a pair of objects do not require that the objects be in contact.

★ Cause and effect relationships of electric or magnetic interactions between two objects (size of force, properties of the objects, distance apart, and orientation relative to each other).

★ Magnets and scientific ideas about magnets can be used to solve problems.

Forces and Interactions

Students who demonstrate understanding can:

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. [**AR** Clarification Statement: Examples could include an unbalanced force on one side of a box can make it start moving or 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.]

Clarifications:

- The strength of force is related to its effect.
- A greater force pushing on an object results in greater change in motion.
- If two equal forces push an object from opposite directions, the object does not move.
- When two forces push in the same direction, their forces are added.
- When two forces push in opposite directions, their forces are subtracted.
- Work only happens if an object moves

Disciplinary Core Ideas

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)

Identify and CLARIFY the STANDARDS

Forces and Interactions

Students who demonstrate understanding can:

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.]

Disciplinary Core Ideas

PS2.A: Forces and Motion

- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

Identify and CLARIFY the STANDARDS

Forces and Interactions

Students who demonstrate understanding can:

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 or 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 paperclips, 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 or 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.]

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.]

Disciplinary Core Ideas

PS2.B: Types of Interactions

- Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3, 3-PS2-4)

Identify and CLARIFY the STANDARDS

PHYSICAL SCIENCE

UNIT:
Forces and Motion

View Unit

CONCEPT:

About Force

Changing Direction

UNIT:
Electricity and Magnetism

View Unit

CONCEPT:

Static Electricity

Magnets

Magnets and Electricity

Discovery Education Science Techbook Units

Gather and study the RESOURCES

Week	Performance Expectation/DCI	Resource
1 & 2 Creating Classroom Culture Background Knowledge (Push and Pull)	**Creating Classroom Culture** **Background Knowledge** **Prior to 3rd grade, students should have knowledge, understanding of, and experiences with the following ideas:** • Objects pull or push each other when they collide or are connected. • When objects touch or collide, they push on one another and can change motion or shape. • Pushes and pulls can have different strengths and directions. • Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. • A bigger push or pull makes things speed up or slow down more quickly. • An object sliding on a surface or sitting on a slope experiences a pull due to friction.	**The 5E Instructional Model** **Engage:** **Option 1:** Show this video and have students discuss their observations. https://www.youtube.com/watch?v=PFPZkOF78xY How could he move the truck? How else could he have moved the truck? Would anything make the truck easier to move? Would anything make it harder to move? How do these changes effect the truck? **Option 2:** Discovery Education: Thinking About What Causes the Motion of Objects to Change. **Explore:** **Exploration 1:** How Far Did It Go? Assessment Probe -intranet **Exploration 2:** Rolling Marbles? Assessment Probe -intranet **Exploration 3:** Discovery Education: It's Game Time. After reading the article, you can have students play the game of marbles. **Explain:** Discovery Education: About Force **Elaborate:** Discovery Education: About Force **Evaluate:** Skate Park Assessment Probe -intranet

Week	Performance Expectation/ DCI	Resource
3-5 Balanced & Unbalanced Forces Observations and Measurement of an Object's Motion *These two standards are to be taught in unison	**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.** [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.] **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.** [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]	Model Lesson for 3-PS2-1 (Force) *Suggestion: You can go through the sessions sequentially. **Assessment Options:** Discovery Education Force Assessments Model Lesson for 3-PS2-2 (Changing Direction) *Suggestion: You can go through the sessions sequentially. **Assessment Options:** Force and Motion Ideas Assessment Probe -intranet Discovery Education Changing Direction Assessments **Other Lesson Options:** Tug of War How Do You Make a Seesaw Teeter-Totter? Associated PowerPoint - Seesaw

DIVIDE the unit into weeks and DISTRIBUTE the standards

Week	Performance Expectation/ DCI	Resource
6	Similar to week one and two, you will need to allow exploration of magnets. In future years, this will be covered within the 2nd grade NGSS standards.	Exploration Options That Will Introduce Students to Magnets: Big and Small Magnets Assessment Probe -intranet Am I Magnetic? Student Page Station Card
7-9 Electric & Magnetic Forces	**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.** [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.] **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.]	Model Lesson for 3-PS2-3 (Static Electricity) **Assessment Options:** Discovery Education Static Electricity Assessment Model Lesson for 3-PS2-3 (Magnets) **Assessment Options:** Discovery Education Magnets Assessment **3-PS2-4** Assessment: How Can I Use a Magnet to Move an Object? Model Lesson for 3-PS2-3 (Magnets & Electricity) **Assessment Options:** Discovery Education Magnets & Electricity Assessment **Additional Assessment Options:** Have students create a board using the Board Builder Tool within Discovery Education. *Go through the tutorial labeled “Before You Start” with your students before they start to build their own board.

Make or locate SUMMATIVE and PERFORMANCE ASSESSMENTS

Assessments from Science Techbook Unit Concept: About Force

Assessment (online)

Assessment

Assign
Print Assessment
Print with Answers

About Force

INSTRUCTIONS
Check your understanding with this practice assessment.

1) Two forces that are equal in magnitude push an object in the same direction. The forces _____.

A) cancel each other

B) decrease by half

C) add together

D) spin out of control

Explanation:
C is the correct answer. It is correct because equal forces pushing an object in the same direction will add together. The sum of the two forces push the object in one direction.

2) According to Newton's Second Law of Motion, an object will only accelerate if there is _____.

A) an unbalanced force acting upon it

B) a balanced force acting upon it

C) a force equal to the mass acting upon it

D) a gravitational force acting upon it

Explanation:
The correct answer is A. It is correct because according to Newton's Second Law of Motion, an object will only accelerate if there is an unbalanced force, or net force, acting upon it.

3) A force is a push or pull, and force is measured in newtons (N). Alex threw a baseball with a force of 10 N. Then he threw the baseball with a force of 15 N. Given this information, what is true?

A) The baseball traveled a total of 25 N.

B) The baseball traveled farther on the first throw.

C) The baseball traveled farther on the second throw.

D) The baseball traveled about the same distance on each throw.

Constructed Response

Discovery EDUCATION™ SCIENCE

Name _____ Date _____

Brief-Constructed Response

About Force

You will need about 15–20 minutes to complete this brief constructed response.

A
Two students are trying to move a heavy desk. One student is pushing the desk to the right. The other student is pushing the desk to the left. The desk does not move. How do the forces the two students are putting on the desk compare? Explain your answer. How much work did each student do? How do you know? If the students want the desk to move to the left, how should they change the forces they are putting on the desk?

Discovery EDUCATION™ SCIENCE

Name _____ Date _____

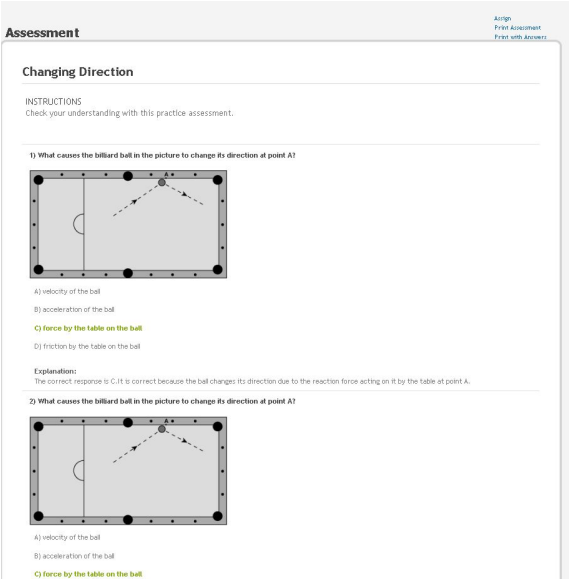
Brief-Constructed Response

B
A person is pulling a wagon north. A second person begins pulling on the wagon. In which direction should the second person pull to make the wagon move more quickly? Explain your answer.

Make or locate SUMMATIVE and PERFORMANCE ASSESSMENTS

Assessments from Science Techbook Unit Concept: Changing Direction

Assessment (online)


Assessment

Assign
Print Assessment
Print with Answers

Changing Direction

INSTRUCTIONS
Check your understanding with this practice assessment.

1) What causes the billiard ball in the picture to change its direction at point A?

A) velocity of the ball

B) acceleration of the ball

C) force by the table on the ball

D) friction by the table on the ball

Explanation:
The correct response is C.It is correct because the ball changes its direction due to the reaction force acting on it by the table at point A.

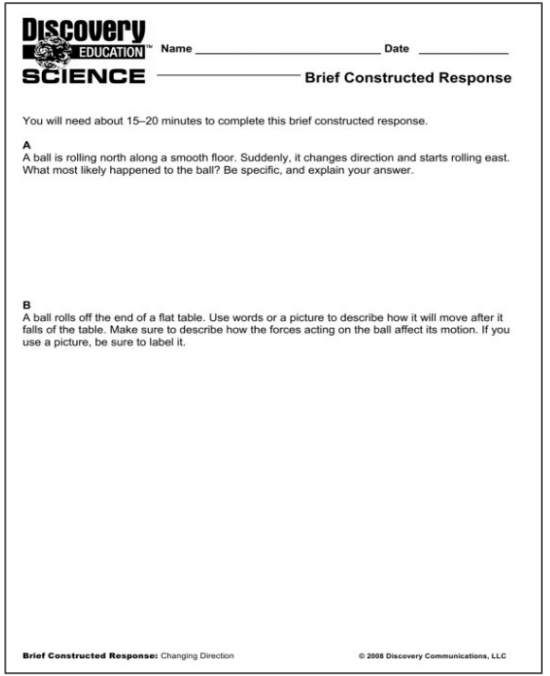
2) What causes the billiard ball in the picture to change its direction at point A?

A) velocity of the ball

B) acceleration of the ball

C) force by the table on the ball

Constructed Response


Discovery EDUCATION™ SCIENCE

Name _____ Date _____

Brief Constructed Response

You will need about 15–20 minutes to complete this brief constructed response.

A
A ball is rolling north along a smooth floor. Suddenly, it changes direction and starts rolling east. What most likely happened to the ball? Be specific, and explain your answer.

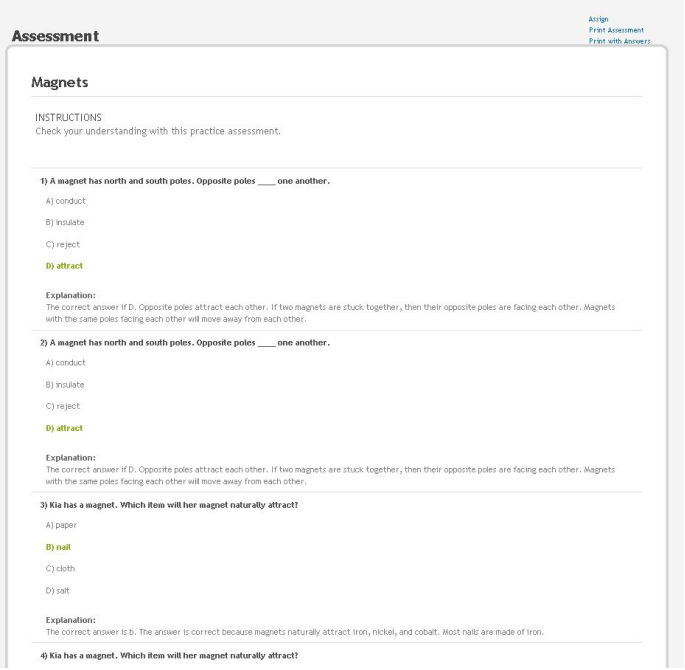
B
A ball rolls off the end of a flat table. Use words or a picture to describe how it will move after it falls of the table. Make sure to describe how the forces acting on the ball affect its motion. If you use a picture, be sure to label it.

Brief Constructed Response: Changing Direction

Make or locate SUMMATIVE and PERFORMANCE ASSESSMENTS

Assessments from Science Techbook Unit Concept: Magnets

Assessment (online)



Assessment

Assign
Print Assessment
Print with Answers

Magnets

INSTRUCTIONS
Check your understanding with this practice assessment.

1) A magnet has north and south poles. Opposite poles ___ one another.

A) conduct

B) insulate

C) reject

D) attract

Explanation:
The correct answer is D. Opposite poles attract each other. If two magnets are stuck together, then their opposite poles are facing each other. Magnets with the same poles facing each other will move away from each other.

2) A magnet has north and south poles. Opposite poles ___ one another.

A) conduct

B) insulate

C) reject

D) attract

Explanation:
The correct answer is D. Opposite poles attract each other. If two magnets are stuck together, then their opposite poles are facing each other. Magnets with the same poles facing each other will move away from each other.

3) Kia has a magnet. Which item will her magnet naturally attract?

A) paper

B) nail

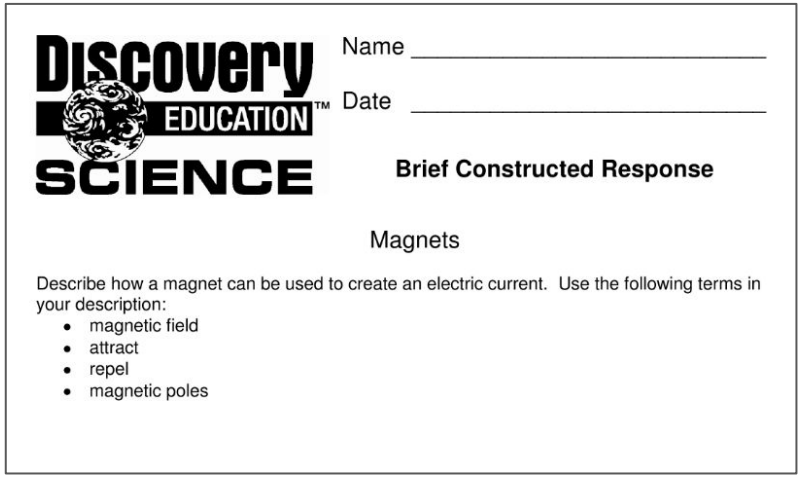
C) cloth

D) salt

Explanation:
The correct answer is b. The answer is correct because magnets naturally attract iron, nickel, and cobalt. Most nails are made of iron.

4) Kia has a magnet. Which item will her magnet naturally attract?

Constructed Response



Discovery EDUCATION™ SCIENCE

Name _____

Date _____

Brief Constructed Response

Magnets

Describe how a magnet can be used to create an electric current. Use the following terms in your description:

- magnetic field
- attract
- repel
- magnetic poles

Make or locate SUMMATIVE and PERFORMANCE ASSESSMENTS

Assessments from Science Techbook Unit Concept: Magnets & Electricity

Assessment (online)

Assessment

Assign
Print Assessment
Print with Answers

Magnets and Electricity

INSTRUCTIONS
Check your understanding with this practice assessment.

1) How is a magnetic field created for an electromagnet?

A) It has to be lined up with Earth's magnetic field.

B) It has to be touching another magnet.

C) Heat must be introduced.

D) It must have an electrical source.

Explanation:
The correct answer is D. Magentic fields in electromagnets are produced when a metal core inside a coil receives an electric current.

2) How is a magnetic field created for an electromagnet?

A) It has to be lined up with Earth's magnetic field.

B) It has to be touching another magnet.

C) Heat must be introduced.

D) It must have an electrical source.

Explanation:
The correct answer is D. Magentic fields in electromagnets are produced when a metal core inside a coil receives an electric current.

3) What advantage does an electromagnet have over a permanent magnet?

A) Electromagnets are easier to make than permanent magnets.

B) Electromagnets are lighter than permanent magnets.

C) Electromagnets can attract different materials than permanent magnets.

D) Electromagnets can be turned off and on.

Explanation:

4) What advantage does an electromagnet have over a permanent magnet?

A) Electromagnets are easier to make than permanent magnets.

B) Electromagnets are lighter than permanent magnets.

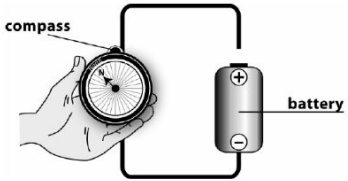
Constructed Response

Discovery EDUCATION™ SCIENCE

Name _____ Date _____

Brief Constructed Response

You will need about 15–20 minutes to complete this brief constructed response.



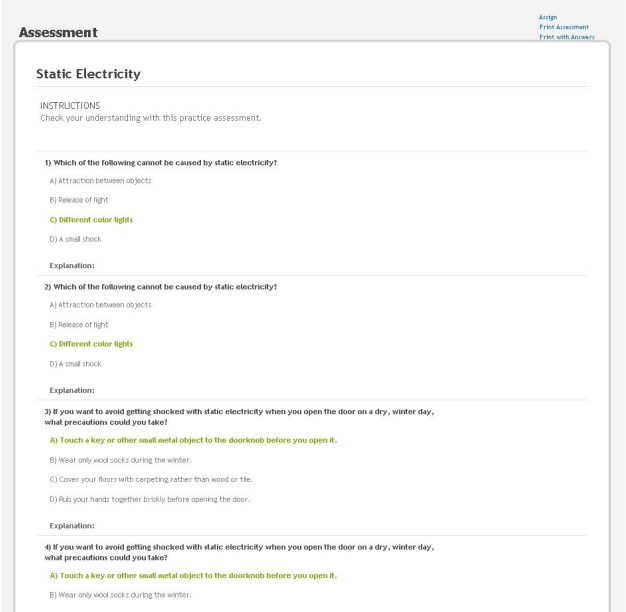
A
What will happen to the compass needle when the free end of the wire is connected to the positive end (+) of the battery? Why?

B
Describe how this effect is used in motors and generators.

Make or locate SUMMATIVE and PERFORMANCE ASSESSMENTS

Assessments from Science Techbook Unit Concept: Static Electricity

Assessment (online)


Assessment

Assign
Print Assessment
Print with Answers

Static Electricity

INSTRUCTIONS
Check your understanding with this practice assessment.

1) Which of the following cannot be caused by static electricity?

A) Attraction between objects

B) Release of light

C) Different color lights

D) A small shock

Explanation:

2) Which of the following cannot be caused by static electricity?

A) Attraction between objects

B) Release of light

C) Different color lights

D) A small shock

Explanation:

3) If you want to avoid getting shocked with static electricity when you open the door on a dry, winter day, what precautions could you take?

A) Touch a key or other small metal object to the doorknob before you open it.

B) Wear only wool socks during the winter.

C) Cover your floors with carpeting rather than wood or tile.

D) Rub your hands together briskly before opening the door.

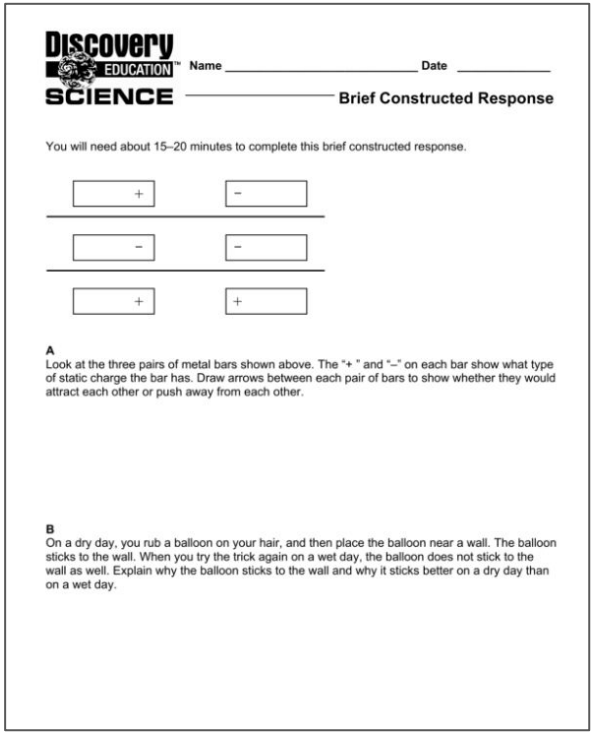
Explanation:

4) If you want to avoid getting shocked with static electricity when you open the door on a dry, winter day, what precautions could you take?

A) Touch a key or other small metal object to the doorknob before you open it.

B) Wear only wool socks during the winter.

Constructed Response


Discovery EDUCATION™ SCIENCE

Name _____ Date _____

Brief Constructed Response

You will need about 15–20 minutes to complete this brief constructed response.

+	–
–	–
+	+

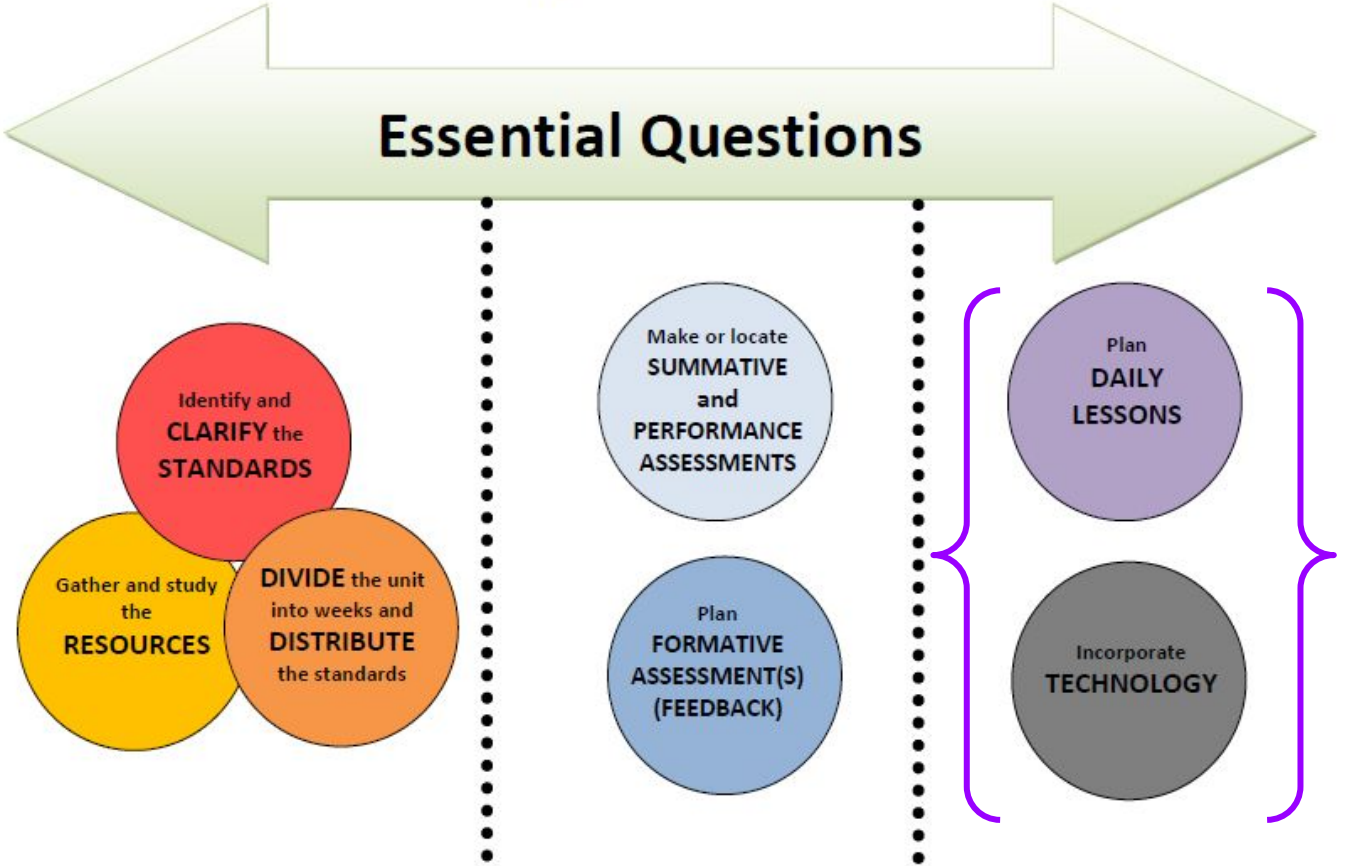
A

Look at the three pairs of metal bars shown above. The "+ " and "–" on each bar show what type of static charge the bar has. Draw arrows between each pair of bars to show whether they would attract each other or push away from each other.

B

On a dry day, you rub a balloon on your hair, and then place the balloon near a wall. The balloon sticks to the wall. When you try the trick again on a wet day, the balloon does not stick to the wall as well. Explain why the balloon sticks to the wall and why it sticks better on a dry day than on a wet day.

Backward Unit Planning 1.0



Now you're ready to plan your daily lessons!