FORCES AND INTERACTIONS

differentiated passages bundle

3rd Grade NGSS

MagiCORE

ABOUT LEXILE LEVELS

MagiCore Learning, LLC is a certified Lexile® Partner. These texts are officially measured and approved by Lexile and MetaMetrics® to ensure appropriate rigor and differentiation for students.

The Lexile Framework® for Reading measures are scientific, quantitative text levels. When the Lexile of a text is measured, specific, measurable attributes of the text are considered, including, but not limited to, word frequency, sentence length, and text cohesion. These are difficult attributes for humans to evaluate, so a computer measures them.

Common Core State Standards uses Lexile level bands as one measure of text complexity. Text complexity ranges ensure students are college and career ready by the end of 12th grade. Lexile measures help educators scaffold and differentiate instruction as well as monitor reading growth.

Grade Band	Lexile® Bands Aligned to Common Core Expectations
K-1	N/A
2-3	420L-820L
4-5	740L-1010L
6-8	925L-1185L

Keep in mind when using any leveled text that many students will need scaffolding and support to reach text at the high end of their grade band. According to Appendix A of the Common Core Standards, "It is important to recognize that scaffolding often is entirely appropriate. The expectation that scaffolding will occur with particularly challenging texts is built into the Standards' grade-by-grade text complexity expectations, for example. The general movement, however, should be toward decreasing scaffolding and increasing independence both within and across the text complexity bands defined in the Standards."

Balanced and Unbalanced Forces

3rd grade

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Each passage set includes two differentiated passages on a third-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes seven differentiated passages aligned to the following standard:

3-PS2-1: Balanced and Unbalanced Forces
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. (Cause and Effect)

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.

Here are some suggestions for using these passages:

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.

480L

Name: ____ Date: _______________________

Newton's Discovery of the Laws of Motion

Isaac Newton

Gravity is an invisible **force.** It pulls objects toward each other. Gravity makes something you drop fall to the ground. Forces, gravity, and **motion** are all a part of your life.

How do we know about these ideas? Sir Isaac Newton helped. He was born on January 4, 1643, in England. Newton didn't want to be a farmer like his father. He stayed in school instead. He went to the University of Cambridge's Trinity College in 1661. In 1665, a sickness closed the college. Newton spent time back at his home. He kept learning, though. He made many **theories,** or ideas, about science and mathematics.

Newton spent much time alone. It was said he sat below an apple tree. An apple may have fallen on him. He thought about forces and motion after this. He studied objects. He tested what forces act on them. He learned how those forces affected the objects. Newton's **experiments** led to his understanding of gravity. He used it to describe the movements of the planets and the sun. He developed his three laws of motion in 1666.

Newton's three laws of motion have been proven by other scientists. The laws have led to many different inventions. Humans are able to travel into space because of Newton's laws. Sir Isaac Newton died on March 31, 1727. His discoveries live on. They affect your everyday life.

Newton's Discovery of the Laws of Motion Questions

1. What happened during each of these significant years in Newton's life:

   1643: ____

   1661: ____

   1665: ____

   1666: ____

   1727: ____

2. What is gravity?

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3. Describe the experiments that Newton did. What did they lead him to understand?

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4. Describe a situation where you have experienced gravity.

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740L

Name: ____ Date: ______________________

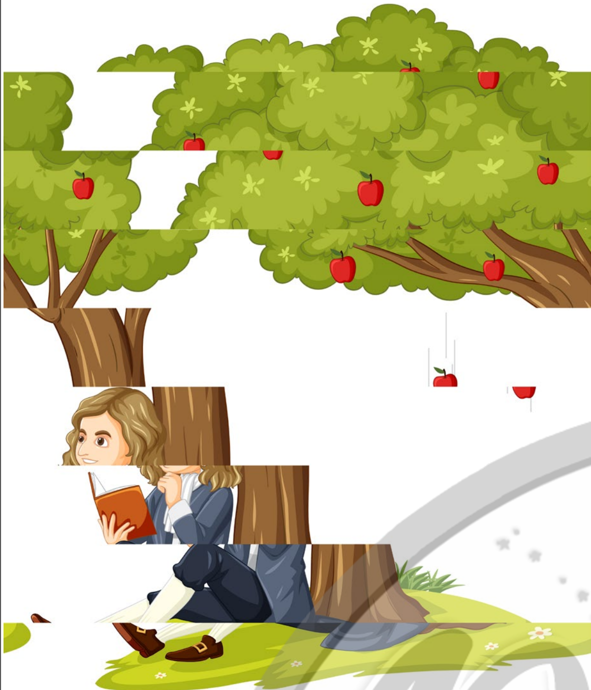
Newton's Discovery of the Laws of Motion

Anyone who has ever dropped something knows about **gravity**. Gravity is an invisible **force** that pulls objects toward each other. Earth's gravity is what makes that fork you dropped at the dinner table clatter to the floor. It's also what keeps you in your seat when you're playing your favorite video game. Do you like baseball? Forces, gravity, and **motion** are all at work on the baseball field, too. Without an understanding of these ideas, life on Earth would be different.

Isaac Newton

A replica of Newton's reflecting telescope he invented.

How do we know about gravity, forces, and motion? One important scientist who helped humans understand these ideas was Sir Isaac Newton. He was born on January 4, 1643, in England. Raised by his grandmother, Newton didn't want to be a farmer as his father had been. He stayed in school instead. He attended the University of Cambridge's Trinity College in 1661. In 1665, a sickness closed the college. Newton spent time back at his home. He kept learning, though. He developed many **theories,** or ideas, about science and mathematics.



It was during this time alone that Newton was said to have been sitting below an apple tree. An apple was said to have fallen on him. This event supposedly caused him to think about forces and motion. Writings have proven that Newton did witness an apple falling. He was then inspired to study objects, what forces act upon them, and how those forces affect the objects. The reports, however, didn't say he was actually hit with the apple. Newton's **experiments** and studies led to him using gravity to describe the movements of the planets and the sun. He developed his three laws of motion in 1666. He was only 23 years old. Newton also invented a type of math called **calculus**. This math is used in engineering and science. The reflecting **telescope** is a tool Newton invented that is still used in astronomy today.

Newton's three laws of motion have been proven by many other scientists over the years. These laws became the basis for **physics**. Physics is the study of matter, motion, and energy. Newton's work has affected other branches of science, too. They have contributed to many different inventions. Humans are able to travel into space due to Newton's three laws of motion. Sir Isaac Newton died on March 31, 1727. His discoveries live on and affect your everyday life.

Newton's Discovery of the Laws of Motion Questions

1. What happened during each of these significant years in Newton's life:

    1643: ____

    1661: ____

    1665: ____

    1666: ____

    1727: ____

2. What is gravity?

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3. Describe the experiments that Newton did. What did they lead him to understand?

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4. Describe a situation where you have experienced gravity.

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500L

Name: _________________________________ Date: ____________________

Why Do Ships Float?

USS Gerald R. Ford

The USS Gerald R. Ford is a ship. It is part of the United States Navy. The ship is huge. It can hold more than 4,500 people. The USS Gerald R. Ford is an aircraft carrier. This means it has airplanes. It also has a huge runway. It can hold up to 90 airplanes.

You must be thinking, "that's a lot of stuff to put on a boat." And it is. The USS Gerald R. Ford weighs over 90,000 tons. That's about the same as 14,000 African elephants. So how does it float?

Boats have been used for a long time. We didn't always know what made them float. Early boats were made of wood. Have you thrown a stick into a pond? Then you know that wood floats. Wood is less dense than water. It naturally floats. People thought boats float because they are made of wood. But metal is a different story. If you threw a piece of metal into a pond, it would sink. So how did humans figure out how to make metal boats?

They used the law of **balanced forces**. A Greek scientist named Archimedes made an important discovery. He filled his bathtub to the top with water. He stepped in. The water rose and overflowed. He put other objects in water. He noticed that made the water rise. He began measuring the changes in water levels. He measured the level when different objects were placed in the water. He could predict how high the water would rise. The height was equal to the volume of the object in the water. The amount the water rose was different if the object floated. The water didn't rise as high. It only rose by the volume of the portion of the object that was under water.

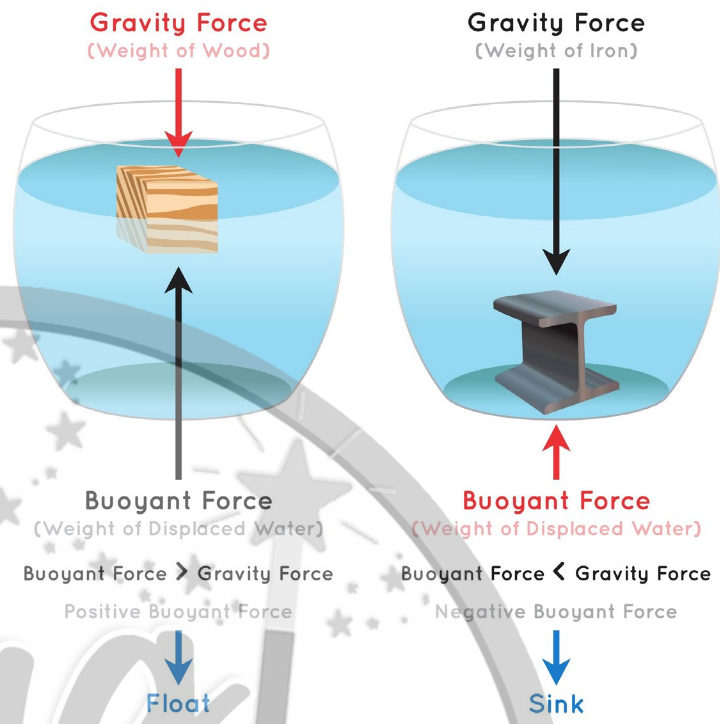

Diagram showing gravity and buoyant force

So how does this help us understand how big boats float? Well, Archimedes made a theory. He said the water pushes upward against floating objects. He called this the **buoyant force**. He measured the **mass** of the water that was displaced by a floating object. This mass was equal to the mass of the object. So, the water pushes back on the object with the exact force that the object pushed down on the water.

We can apply this to the USS Gerald R. Ford. The ship weighs 90,000 tons. So, it's pushing down with 90,000 tons of force. For the ship to float, it must displace at least 90,000 tons of water. If designed correctly, the water will push against the ship. The force of the water pushing up will be equal to the force of the ship pushing down. This creates a **balance** of forces. The force of the ship's weight and the buoyant force must be balanced. This makes the ship float.

Archimedes' Principle shows us heavy objects can float. But only if forces are balanced.

Why Do Ships Float Questions

1. What happens when an object is placed in water?
   a. The water level rises
   b. The water level drops
   c. The water level does not change
   d. The water level sometimes rises and sometimes drops

2. Describe the "buoyant force". How does it make things float?

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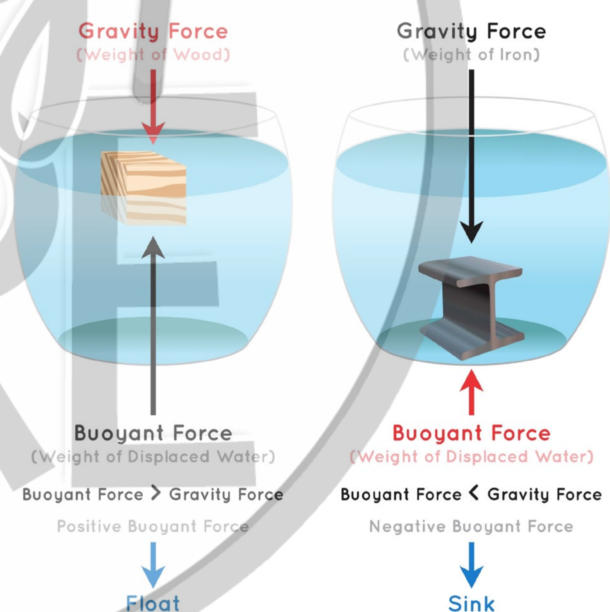
3. Refer to the diagram. What happens when the buoyant force is less than the force of gravity?



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4. How do balanced forces explain how a ship as heavy as the USS Gerald R. Ford floats?

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Predicting Future Motion

3rd grade

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Each passage set includes two differentiated passages on a third-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes six differentiated passages aligned to the following standard:

3-PS2-2 Predicting Future Motion
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 seesaw.

Assessment Boundary: Assessment does not include technical terms such as period and frequency.

Here are some suggestions for using these passages:

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.

490L

Name: ____ Date: _______________________

Bouncing Balls

Balls are used in a variety of popular sports. We use them in basketball, soccer, and tennis. These balls bounce. This is because of **collisions**. A collision is when one moving object strikes against another. A basketball collides with the ground. A soccer ball collides with a player's foot. A tennis ball collides with a racket. These collisions send the balls in a new direction. They travel opposite from their original path.

Soccer players kicking a soccer ball.

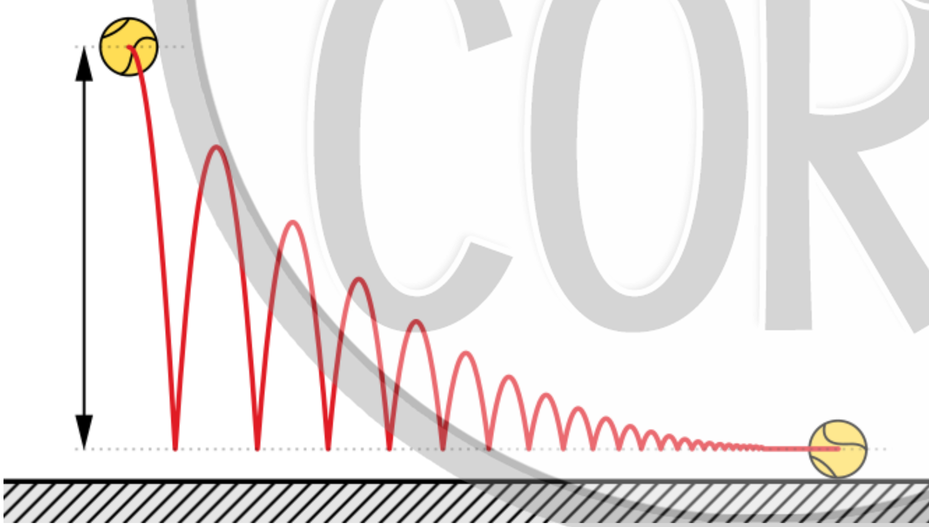

Diagram showing a bouncing ball

A falling ball gains speed when it's dropped. **Gravity** pulls it down. It is full of **kinetic energy** as it moves. The ball collides with the ground. That kinetic energy has to go somewhere. The energy goes into deforming the ball. It goes from its round shape to a squashed one. This happens very quickly. The ground then pushes back against the ball. It regains its original shape. Then it shoots back up. Some energy has been lost as heat. The ball's upward motion will be shorter. With each bounce, more energy is lost. Finally, gravity wins. It slows the ball down. The bounces get shorter and shorter. Eventually, the ball stops bouncing.

Baseball

Rubber ball

The properties of the ball affect its bounce as well. The material it is made of is a big factor. The texture of its surface matters, too. A plain, smooth, rubber ball, for example, will bounce high. A baseball that is covered with leather won't bounce as high. The rubber ball has more **elasticity** than the baseball. The amount of air in a ball also affects the height of its bounce. Size and weight affect bounce height, too.

The height from which a ball is dropped affects its bounce. One ball is dropped from a 75-centimeter height. One ball is dropped from a 55-centimeter height. The ball that was dropped from a 75-centimeter height will bounce higher. Balls with a higher starting point have higher **potential energy**. Earth's gravity has more time to **accelerate** the ball. It has more time to build up speed. That's why it can bounce higher and faster.

Bouncing a ball can be a fun activity. It allows you to play your favorite sport. You can understand that energy and gravity are at work. Then you can be a scientist as well as an athlete.

Bouncing Balls Questions

1. Use the chart below to describe how balls bounce.

	→	The ball's round shape is squashed by the ground.	→		→	The ball bounces back up into the air.

2. The author uses the phrase, "Finally, gravity wins." to describe what happens to bouncing balls. Explain how gravity "wins" and what the author meant.

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3. Which of the following will affect how a ball bounces? (Choose all that apply.)
   a. The material the ball is made of
   b. The color of the ball
   c. The amount of air inside the ball
   d. The size of the ball

4. Explain why balls that are bounced with a higher starting point bounce higher.

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790L

Name: ____ Date: ______________________

Bouncing Balls

Balls are used in a variety of popular sports such as basketball, soccer, and tennis. These balls bounce because of **collisions**. A collision is when one moving object strikes against another. A basketball collides with the ground. A soccer ball collides with a player's foot. A tennis ball collides with a racket. These collisions send the balls in a direction that is opposite to their original path.

Soccer players kicking a soccer ball.

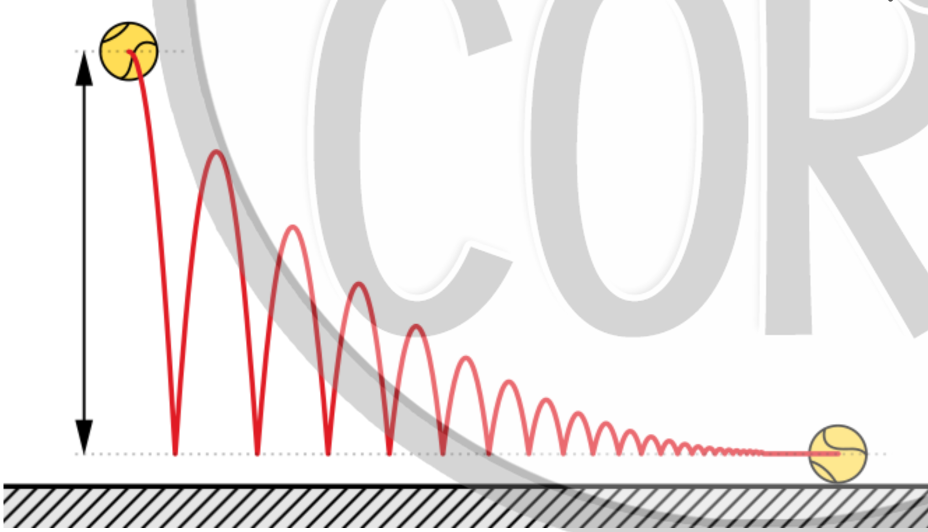

Diagram showing a bouncing ball

A falling ball gains speed when it's dropped. This is because **gravity** pulls it down. It is full of **kinetic energy** as it moves toward the ground. The ball collides with the ground, and that kinetic energy has to go somewhere. The energy goes into deforming the ball from its round shape to a squashed one. This happens very quickly. The ground then pushes back against the ball. It regains its original shape and shoots back up. Some energy has been lost as heat, however. The ball's upward motion will be shorter now. With each bounce, more energy is lost. Finally, gravity wins, slowing the ball down so the bounces get shorter and shorter. Eventually, the ball stops bouncing altogether.

Baseball

Rubber ball

The properties of the ball affect its bounce as well. The material it is made of and the texture of its surface are big factors. A plain, smooth, rubber ball, for example, will bounce higher than a baseball that is covered with leather. The rubber ball has more **elasticity** than the baseball. The amount of air in a ball also affects the height of its bounce as do size and weight.

The height from which a ball is dropped affects its bounce also. A ball dropped from a 75-centimeter height will bounce higher than the same kind of ball dropped from a 55-centimeter height. This is because balls with a higher starting point have higher **potential energy**. Earth's gravity has more time to **accelerate** the ball when it has farther to travel so it can bounce higher and faster.

Bouncing a ball can be a fun activity and allows you to play your favorite sport. Understanding that energy and gravity are at work lets you be a scientist as well as an athlete.

Bouncing Balls Questions

1. Use the chart below to describe how balls bounce.

2. The author uses the phrase, "Finally, gravity wins." to describe what happens to bouncing balls. Explain how gravity "wins" and what the author meant.

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3. Which of the following will affect how a ball bounces? (Choose all that apply.)
    a. The material the ball is made of
    b. The color of the ball
    c. The amount of air inside the ball
    d. The size of the ball

4. Explain why balls that are bounced with a higher starting point bounce higher.

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Electric and Magnetic Forces

3rd grade

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Each passage set includes two differentiated passages on a third-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes seven differentiated passages aligned to the following standard:

3-PS2-3: Electric and Magnetic Forces

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 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 the 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.

Here are some suggestions for using these passages:

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.

480L

Name: ____ Date: _______________________

Electricity

Do you like watching TV? Do microwaves make your life easier? You depend on electricity if you answered yes. Electricity provides energy.

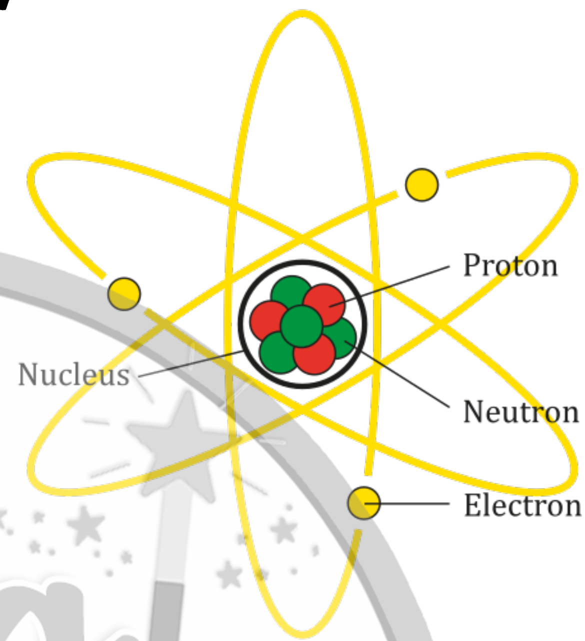


Diagram of an atom.

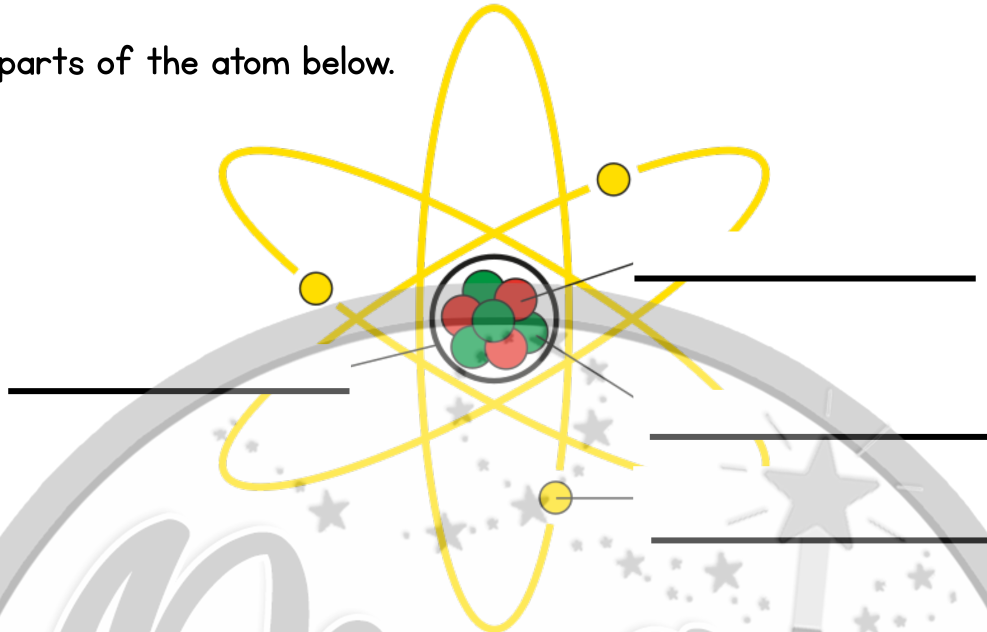
Everything is made of atoms. **Protons**, **electrons**, and **neutrons** are inside atoms. Protons have positive **charges**. Electrons are negative. Neutrons have no charge. Protons and neutrons are in the center of the atom. Electrons spin around the center. The positive charges attract the negative charges. This keeps the electrons from flying out of the atom.

Some electrons can be freed from an atom. A force releases them. The electrons then move to another atom. Electricity is made when electrons move between atoms. Moving electrons makes an electric **current**. This current travels through an electric **circuit**. A circuit is a path for electricity.

Electric current can be measured. Ohm's Law is used. Georg Simon Ohm was a German scientist. He studied current. He examined the force creating the flow of electrons. He also looked at the force working to stop the flow. Ohm figured out how these are related. He said the **voltage** of the power source equals the current multiplied by the **resistance**. Ohm's Law is a part of many devices. Ceiling fans use Ohm's law. Electric heaters also use Ohm's Law. This law allows people to better understand electricity.

Electricity Questions

1. Label the parts of the atom below.



2. Describe how protons, neutrons, and electrons work together to keep electrons from flying out of the atom.

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3. What happens with electrons to make electricity?

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4. Describe Ohm's Law. List 3 household items that use Ohm's Law.

790L

Name: ____ Date: ______________________

Electricity

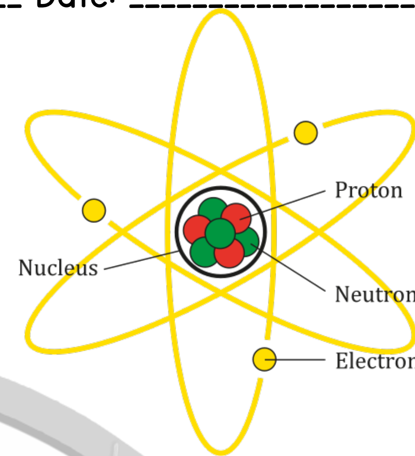


Diagram of an atom.

Do you enjoy watching TV? How much fun do you have playing games or learning on a computer? Do machines like microwaves make your life easier? If you answered yes to these questions, you depend on **electricity** in your life. Electricity provides energy.

Everything in the world is made of **atoms**. Tiny particles called **protons**, **electrons**, and **neutrons** are inside atoms. Protons have positive **charges**, while electrons are negative. Neutrons have no charge. Protons and neutrons are in the center of the atom. Electrons, however, spin around the center. The protons' positive charges attract the electrons' negative charges. This keeps the electrons from flying out of the atom.

If a force is applied to the atoms, though, some electrons can be released from it. These electrons then move to another atom. When electrons are moving from atom to atom, electricity is created. Many moving electrons make an electric **current**. This current travels through an electric **circuit**. A circuit creates a path for electricity. Circuits have a power source, such as a battery. They also have wires that carry the current from the power source to the item being powered, such as a light bulb. A switch controls the flow of electric current in a circuit.

Electric current can be measured using Ohm's Law. Georg Simon Ohm was a German scientist. In 1827, he figured out how current, the force creating the flow of electrons, and the force working to stop the flow are related. Ohm discovered that the **voltage** of the power source equals the current multiplied by the **resistance**. Ohm's Law is at work in devices such as ceiling fans, electric heaters, and cell phones. This law allows people to better understand and use electricity.

Electricity Questions

1. Draw and label the parts of an atom below.

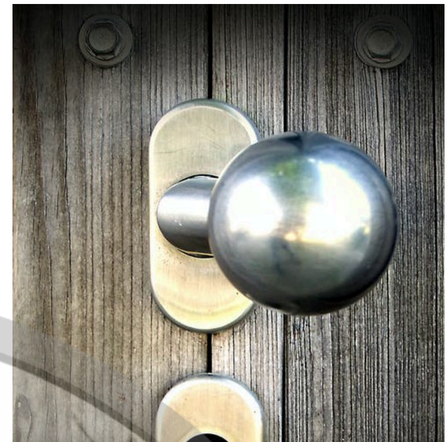
2. Describe how protons, neutrons, and electrons work together to keep electrons from flying out of the atom.

3. What happens with electrons to make electricity?

4. Describe Ohm's Law. List 3 household items that use Ohm's Law.

740L Name: ______________________ Date: ______________________

Shocking!


Metal doorknob.

It's a cold Saturday morning during winter. You've been scuffling across the carpets in the house while wearing your cozy wool socks. What happens when you touch a doorknob?

ZAP!

You get a sudden shock when your hand makes contact with the metal doorknob. This doesn't seriously hurt you. It can be surprising and a little annoying, though. The reason this happens is because of **electrons**. Electrons, along with **protons** and **neutrons**, are found in **atoms**, the building blocks of everything in the world. Electrons are negatively charged, while protons have a positive **charge**. Neutrons have no charge. Protons and neutrons hang out at the center of atoms. Electrons circle the atom's center. They stay in the atom because they are attracted to the protons' positive charges. The atom has the same number of protons and electrons in this case. It's not positively or negatively charged.

When you travel across that carpet, however, your wool socks act as a **conductor**. Conductors allow electrons to move easily through them. You pick up extra electrons on your journey. You now have a negative charge. The doorknob you touch has a positive charge. This makes the extra electrons you've collected want to hop to the metal knob. Metal is also a good conductor. The small zap you feel is because of the quick movement of those electrons.

There are a few conditions that made this "shocking" experience possible. First, the winter air is dry. Dry air makes it easier to build up electrons on your skin. Running a humidifier that will add moisture to the air can help lower the risk of getting shocked. Next, you're wearing wool, a material that conducts electricity. You can avoid shocks if you wear cotton socks or leather-soled shoes instead. Carrying around something metal can release the energy before it builds up, too. Dryer sheets can also collect the extra electrons, so they don't stick to you. These tips can help you stay zap-free.

Shocking! Questions

1. Draw the electrons to show why the girl was shocked in the diagram below:

2. What is a conductor?

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3. What are some ways to prevent getting shocked by extra electrons? Explain how these solutions work.

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470L

Name: ____ Date: ________________________

William Gilbert

Painting of William Gilbert.

William Gilbert was born in England in 1544. He went to college at age 14. He earned three college degrees. He was the royal doctor for Queen Elizabeth I. Later, he was the doctor for King James I. Gilbert died in 1603.

Gilbert wasn't only a doctor, though. He was also a scientist. He didn't believe many of the ideas of his time. Most people thought Earth was at the center of the universe. They also thought it didn't move. Gilbert thought these ideas weren't true. His doubts caused him to experiment. He studied **magnetism** and **electricity**. He developed a tool. It used a metal needle and a magnetic rock. In his experiments, he made an important discovery. He found that Earth was really a giant magnet. He said that Earth turned. He also thought **magnetic forces** were what kept planets in their orbits.

Magnetic lodestone attracting paper clips.

Gilbert shared his work in his book. The book is called De Magnete. This book interested scientists. He was the first to study magnets using scientific methods. Some words we use today to describe magnets and electricity came from Gilbert.

William Gilbert Questions

1. Describe the jobs that William Gilbert had. What made him different from other people of his time? What did he disagree about?

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2. Describe the tool William Gilbert made. What did he discover with his tool?

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3. Why is it important to remember William Gilbert? What can we learn from him?

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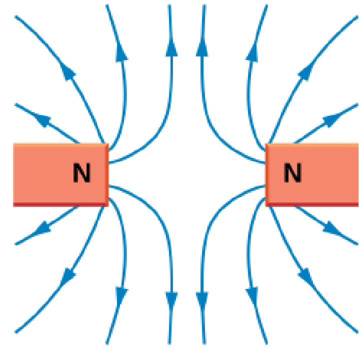
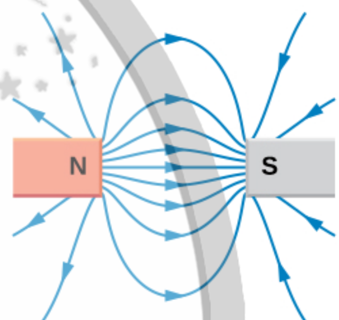
470L

Name: ______________________________ Date: ____________________

Magnetism



Magnetic field lines between like poles



Magnetic field lines between unlike poles

Magnetism is an invisible force. **Magnets** attract or push each other away. They don't have to touch other objects to pull them. Electrons spin in different directions in most objects. Magnets are different. The electrons in magnets spin in the same direction. This makes two **poles**. There is a north pole. There is a south pole. Opposite poles attract each other. Same poles push each other away. The magnetic force flows from the north to the south. This creates a magnetic field.

Magnets are made in different ways. Some magnets are rocks. You can make magnets, too. Rubbing metal with a magnet in the same direction will make a magnet. Iron and steel are good metals to use. Magnets can also be made with electricity. Wrap an iron bar with wire. Run an electric current through the wire. This will create a **magnetic field**.

Compass

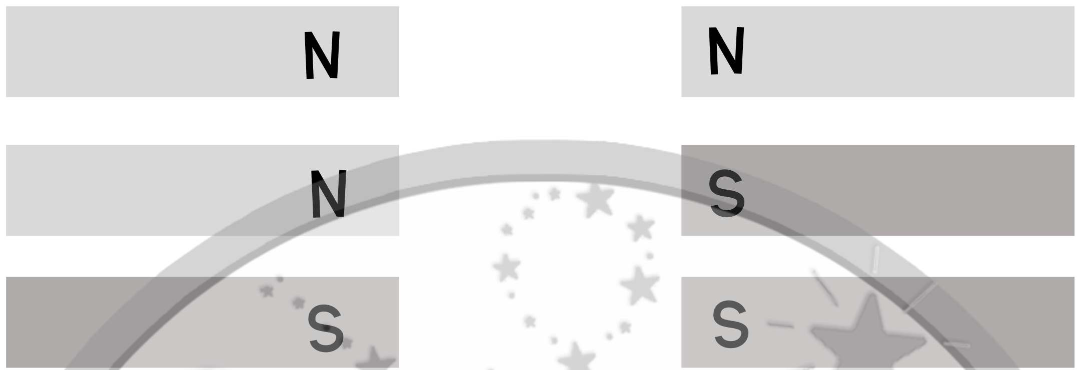
Earth is a giant magnet. That's why magnets work in **compasses**. A compass has a magnetic needle. That needle can turn. The south pole of the magnet is attracted to the north pole of Earth. The needle will always point north.

Magnets are often seen in offices. They hold papers in place. Magnets can keep paper clips from making a mess of a desk. Paper clips are made of steel wire. Magnets attract steel. Paper clips stick to either pole of a magnet. This is because the atoms in the paper clips can adjust themselves.

Our lives are affected by magnets. Electric motors have magnets. Magnets hold doors shut. Electronics use magnets to work. It's safe to say that you meet magnets every day.

Magnetism Questions

1. Draw arrows to show the direction of the magnetic force between the poles.



2. Describe 2 ways to make a magnet.

    1. ____

    ____

    2. ____

    ____

3. List 3 places you have seen magnets working:

    1. ____

    2. ____

    3. ____

Now, describe how the magnet attracts the item in one of your examples:

____

____

____

Magnetic Design Solution

3rd grade

Table of Contents

Each passage set includes two differentiated passages on a third-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes seven differentiated passages aligned to the following standard:

3-PS2-4 Magnetic Design Solution
Define a simple design problem that can be solved by applying scientific ideas about magnets. (Engineering and Technology)

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.

Assessment Boundary: None

Here are some suggestions for using these passages:

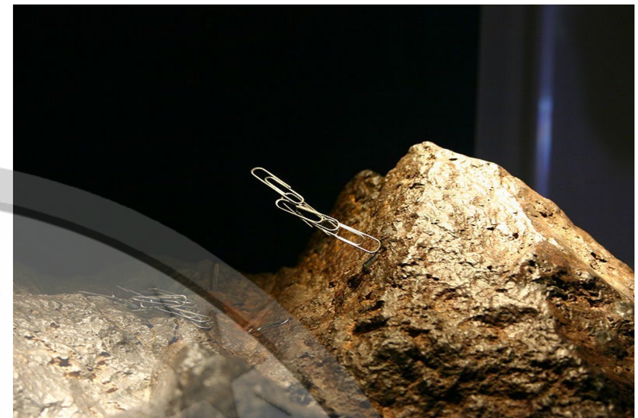
- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.

460L

Name: ______________________________ Date: ____________________

How Do Magnets Work?

Magnetism is a force. It is invisible. A **magnet** is a rock or piece of metal. It can pull types of metal toward itself. Some materials are naturally **magnetic**. One material is a rock called lodestone. It makes a good magnet. Metals such as iron and nickel can become magnets. They have to be exposed to a **magnetic field**. Earth is actually a giant magnet. The Earth has liquid iron in its core. It makes it magnetic. Magnets can also be made with electricity. These are called **electromagnets**.



Lodestone holding paper clips to itself.

Something is magnetic because of its **electrons**. Everything is made of **atoms**. Atoms have particles inside them. **Protons** and **neutrons** are at an atom's center. Electrons spin around the center. They move in different directions in most materials. Electrons spinning in the same direction make something magnetic. These electrons create two **poles**. The **magnetic force** flows from the north to the south. This makes a magnetic field around the magnet.

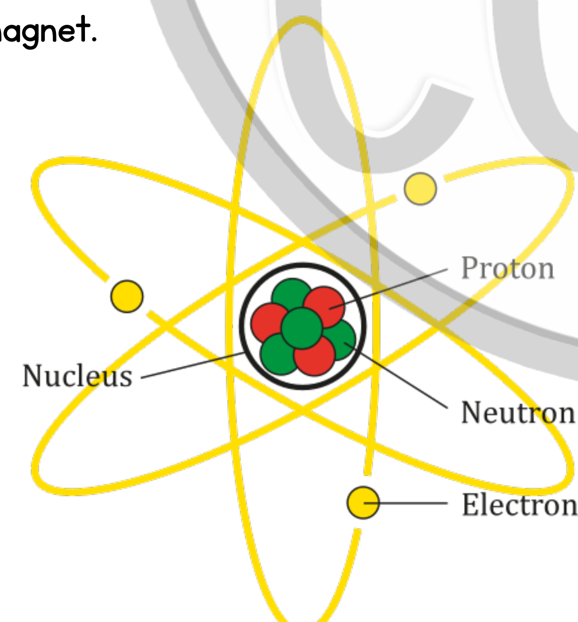


Diagram of an atom

Putting two magnets together shows magnetism. Two north poles will push each other away. Two south poles will do the same. A north pole near a south pole will attract the magnets. Magnets don't need to be touching to work. The magnetic fields work over a distance.

Magnets have many uses. Cars and fans use magnets. Hospitals use magnets to help people. Magnets make our lives easier.

How Do Magnets Work Questions

1. Define the following terms:
   - Magnet – ____
   - Lodestone – ____

2. Describe how we know the Earth is magnetic.

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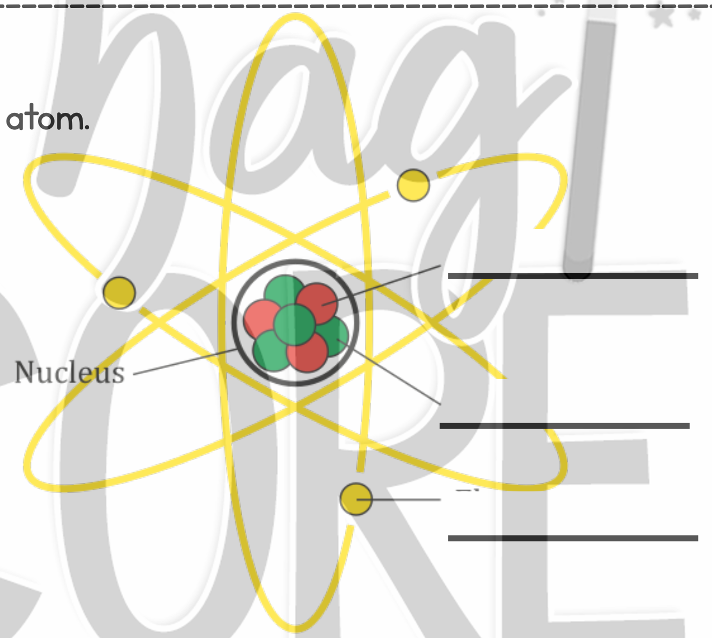
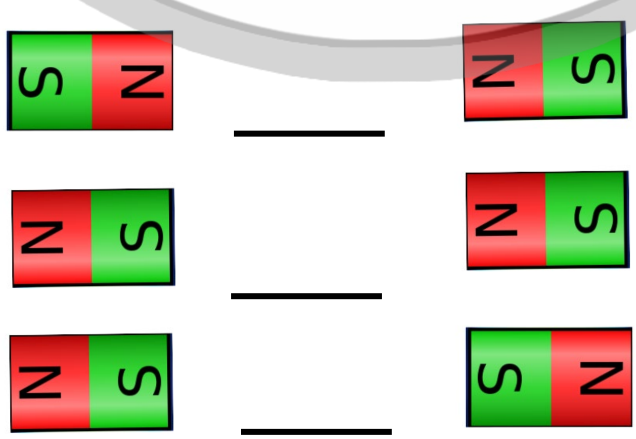
____

3. Label the parts of the atom.



4. Draw arrows between the magnets below to show if the magnets below will be pulled together or pushed apart.



820L

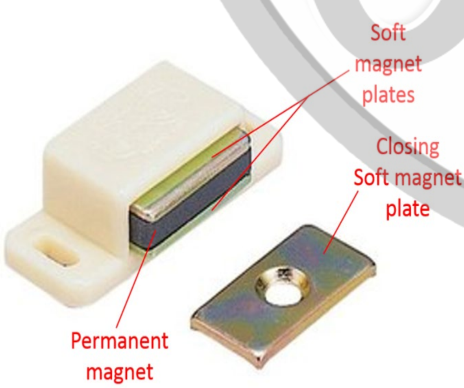
Name: ____ Date: _______________________

A Magnetic Solution

Have you ever closed a kitchen cabinet only to find it won't stay closed? You check out the **hinges**, but they seem fine. You shuffle items around inside the cabinet, thinking it's too full to stay shut. Maybe you even take some things out of the cabinet. Perhaps a bag of chips. You might think eating the chips is the only way to solve your cabinet problem. After you've crunched your way through half the bag, you realize there might be another **solution**.

Magnets!

A stubborn cabinet door can be kept shut by adding a **magnetic catch**. Magnetic door catches are a simple way of keeping a door shut once it's closed. There are usually three pieces involved in this solution – a metal plate, a magnet, and screws. The metal plate is often made of steel. It is fixed to the door using screws. The magnet part is screwed into the inside of the cabinet unit itself.



Magnetic cabinet latch

When the door is shut, the magnet and the metal plate line up perfectly. The metal plate is **attracted** to the magnet. This keeps the door from swinging open until you tug on the door's knob to open the cabinet. If you want the door to be easier to open, set the magnet part a little deeper into the cabinet. It won't touch the metal plate on the door in this case. The door should still stay shut because of the **magnetic field**. Larger doors will need bigger magnets or more of them to stay closed. Magnetic door catches are designed to be hidden. The cabinet will still have a nice, clean look.

Your chips should be safely tucked away inside the cabinet now… if you didn't eat them all!

A Magnetic Solution Questions

1. Use the chart below to describe the problem and solution described in the article.

Problem	Solution

2. Describe how the magnet works to keep the door closed.

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3. Are there any other problems you could solve with a magnetic cabinet latch? Describe what the problem is and how it could be solved.

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480L

Name: ______________________________________ Date: ______________________

Getting Organized

"Clean your room!"

How many times has an adult said this?

One way to stop hearing this is to get organized. Your room gets messy because you have stuff. You use that stuff. You don't always have time to put it away. Getting organized is work at first. It will save you time in the end.

Magnets are great for organizing. Magnets work because **electrons** in their **atoms** spin in the same direction. This makes a **magnetic field**. That field flows between a magnet's **poles**. Opposite poles attract one another. This makes magnets keep things in place.

Magnets holding papers.

Magnets can be used in your room. Magnetic bars can be put on your wall. You can store toy cars and other metal items here. Steel cans can hold supplies such as paintbrushes. The steel cans can be stuck to magnets. Magnetic paint can turn walls into big magnets. Magnetic hooks can be used on the wall. You can hang your art. Metal sheets can be put up, too. This gives you another place that will hold your gear with magnets.

There are many ways to clean up. Magnets are a good choice. You won't have to hear "clean your room" ever again.

Getting Organized Questions

1. Use the chart below to describe the problem and solution described in the article.

Problem	Solution
You need to clean your room and get all your toys off your floor.	

2. Describe how magnets can help you clean up your toys.

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3. Are there any other ways you can think of to use magnets to help organize and clean up around the house? Describe them and how the magnets would work.

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790L

Name: _______________ Date: _______________

Magnets at the Junkyard

People throw away a great deal of metal. Scrap metal can often be made into other items. The junkyard needs a way to sort through the trash it receives. This allows the junkyard to separate the metal from other kinds of garbage. Huge **magnets** are used for this job.

Scrap magnets are big, iron discs. They are attached to large machines called **cranes**. The scrap magnet hangs from a long arm that extends from the crane. It is then moved over the trash heap. This scrap magnet only attracts things that are **magnetic**. Metals such as iron, cobalt, and nickel are the most common metals that get picked up by the scrap magnet.

Unlike natural magnets, scrap magnets are **electromagnets**. This means they are made by running an electric current through coiled wire. The crane operator lowers the iron disc over the trash heap. Electricity powered by a battery is switched on. This **magnetizes** the iron disc. Scrap metal is attracted to the magnetized disc. The crane operator then drives the scrap magnet's load to a location. The collected metal drops from the scrap magnet when the electricity is switched off. Electromagnets like this are not **permanent**. They don't stay magnetic once the electricity is gone.

Scrap magnets can lift several pounds to several tons. It depends on the size of the iron disc. The electric current used and the item being lifted are also factors. The size of the crane affects how much the scrap magnet can hold, too. Some scrap magnets are able to lift entire cars! Others pick up much smaller bits of metal. No matter what they are attracting, scrap magnets are an important part of junkyards.

Magnets at the Junkyard Questions

1. Use the chart below to describe the problem and solution described in the article.

Problem	Solution

2. Describe how magnets can help sort trash at the junkyard.

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3. Can you think of any other places or problems that could benefit from trying this solution? Describe how magnets could help.

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