

EFFECTS OF EVERYDAY FORCES

GRADE 8 & UP READING

Improve students' literacy skills

Sub Plan

Science Applicability



Reading Comment



Extremely satisfied - Great resource to work on student reading comprehension and it tied into the topic I was teaching. My students have been struggling with reading and I've been incorporating more reading into my lessons. Thank you for the resource.



SCROLL
to take a look inside!

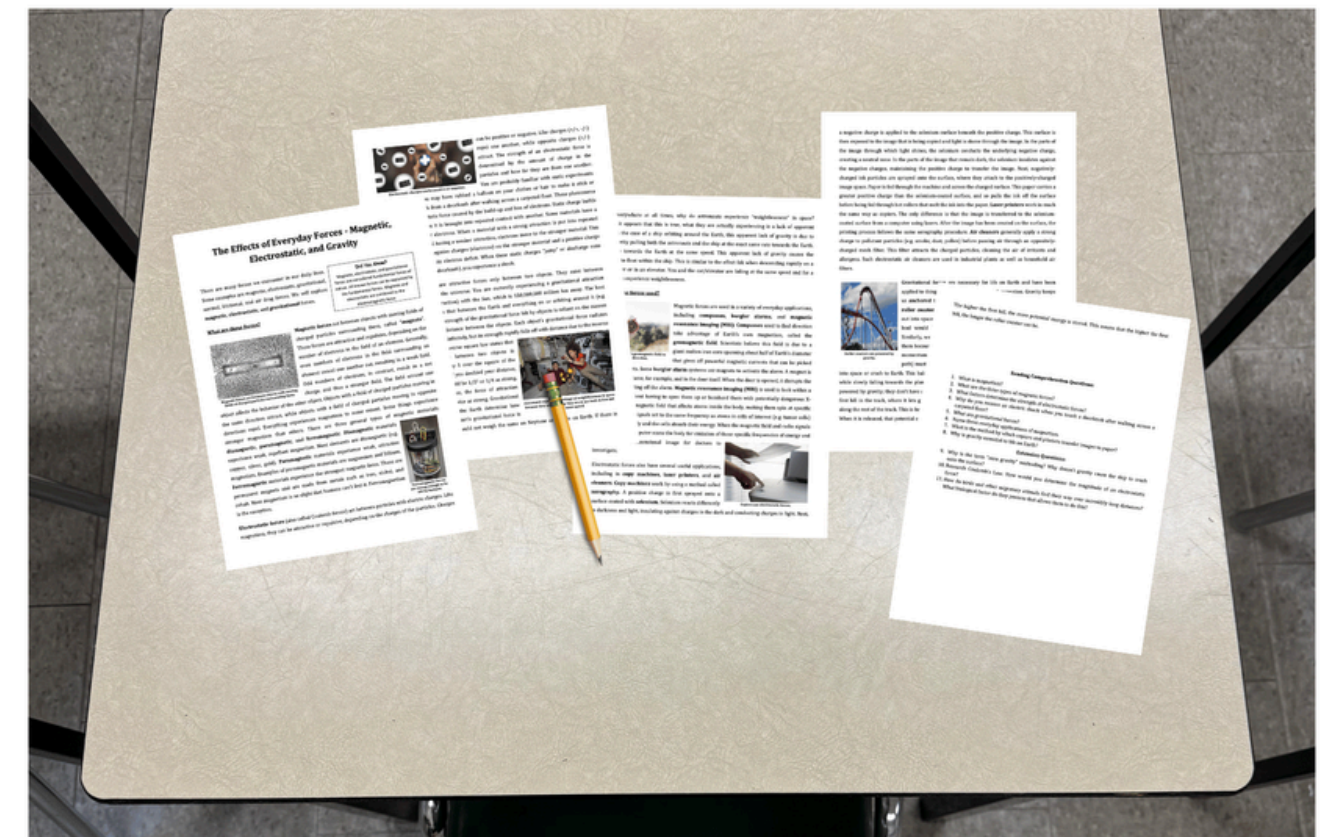


THE PROBLEMS YOU FACE

- Limited time to teach scientific literacy and strengthen students' reading and analysis skills.
- Need meaningful extension activities to engage fast-moving learners.
- Difficulty creating effective last-minute sub plans that still support student learning.

NO-PREP - PRINT/UPLOAD

- **CLASSROOM READY - No Prep, Ready-to-Use:** Print or assign digitally with Google Docs, Microsoft Word, and PDF formats for flexible classroom use
- **Questions and Answer Key**
- **Includes Varied Question Types:** Knowledge, thinking, connecting, application, and open-ended questions.



What Will Your Students Learn?

READING COMPREHENSION ARTICLE & QUESTION BUNDLE

Article with
Comprehension
Questions

Grade 8 and Up

Print & Digital

- Magnetic forces
- Electrostatic forces
- Gravitational forces
- Diamagnetic, paramagnetic, and ferromagnetic materials
- Positive and negative charges
- Static electricity and electric shocks
- Gravity, orbit, and free fall
- Inverse square law
- Compasses, burglar alarms, and MRI machines
- Copy machines, laser printers, and air cleaners
- Satellites, roller coasters, and weightlessness in space

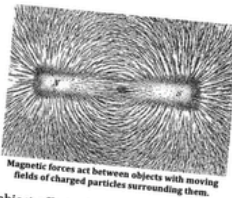
Reading Comprehension Questions:

1. What is magnetism?
2. What are the three types of magnetic forces?
3. What factors determine the strength of electrostatic forces?
4. Why do you receive an electric shock when you touch a doorknob after walking on a carpet?

The Effects of Everyday Forces - Magnetic, Electrostatic, and Gravity

There are many forces we encounter in our daily lives. Some examples are magnetic, electrostatic, gravitational, normal, frictional, and air drag forces. We will explore magnetic, electrostatic, and gravitational forces.

What are these forces?



Magnetic forces act between objects with moving fields of charged particles surrounding them, called "magnets". These forces are attractive and repulsive, depending on the number of electrons in the field of an element. Generally, even numbers of electrons in the field surrounding an element cancel one another out, resulting in a weak field.

Odd numbers of electrons, in contrast, result in a net charge, and thus a stronger field. The field around one object affects the behavior of the other object. Objects with a field of charged particles moving in the same direction attract, while objects with a field of charged particles moving in opposite directions repel. Everything experiences magnetism to some extent. Some things experience stronger magnetism than others. There are three general types of magnetic materials: diamagnetic, paramagnetic, and ferromagnetic. Diamagnetic materials experience weak, repellant magnetism. Most elements are diamagnetic (e.g., copper, silver, gold). Paramagnetic materials experience weak, attractive magnetism. Examples of paramagnetic materials include aluminum and lithium.

Ferromagnetic materials experience strong, attractive magnetism. Examples of ferromagnetic materials include iron, nickel, and cobalt. Most permanent magnets are made of ferromagnetic materials.

Did You Know?
Magnetic, electrostatic, and gravitational forces are considered fundamental forces of nature. All known forces can be explained by the fundamental forces. Magnetic and electrostatic are combined as the electromagnetic force.



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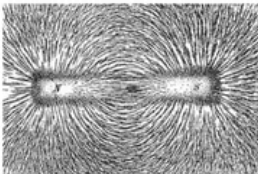
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Your Reading

The Effects of Everyday Forces - Magnetic, Electrostatic, and Gravity

There are many forces we encounter in our daily lives. Some examples are magnetic, electrostatic, gravitational, normal, frictional, and air drag forces. We will explore **magnetic, electrostatic, and gravitational** forces.

What are these forces?



Magnetic forces act between objects with moving fields of charged particles surrounding them.

Magnetic forces act between objects with moving fields of charged particles surrounding them, called **"magnets"**. These forces are attractive and repulsive, depending on the number of electrons in the field of an element. Generally, even numbers of electrons in the field surrounding an element cancel one another out, resulting in a weak field. Odd numbers of electrons, in contrast, result in a net charge, and thus a stronger field. The field around one object affects the behavior of the other object. Objects with a field of charged particles moving in the same direction attract, while objects with a field of charged particles moving in opposite directions repel. Everything experiences magnetism to some extent. Some things experience stronger magnetism than others. There are three general types of magnetic materials: **diamagnetic**, **paramagnetic**, and **ferromagnetic**. **Diamagnetic** materials experience weak, repellant magnetism. Most elements are diamagnetic (e.g. copper, silver, gold). **Paramagnetic** materials experience weak, attractive magnetism. Examples of paramagnetic materials are magnesium and lithium. **Ferromagnetic** materials experience the strongest magnetic force. These are permanent magnets and are made from metals such as iron, nickel, and cobalt. Most magnetism is so slight that humans can't feel it. Ferromagnetism is the exception.



Ferromagnetic forces are strong enough to be felt by humans.

Electrostatic forces (also called Coulomb forces) act between particles with electric charges. Like magnetism, they can be attractive or repulsive, depending on the charges of the particles. Charges

Did You Know?

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Electrostatic charges can be positive or negative.

can be positive or negative. Like charges (+/+, -/-) repel one another, while opposite charges (+/-) attract. The strength of an electrostatic force is determined by the amount of charge in the particles and how far they are from one another. You are probably familiar with static experiments and static shocks. You may have rubbed a balloon on your clothes or hair to make it stick or received a small shock from a doorknob after walking across a carpeted floor. These phenomena are due to an electrostatic force caused by the build-up and loss of electrons. Static charge builds up on a material when it is brought into repeated contact with another. Some materials have a stronger attraction for electrons. When a material with a strong attraction is put into repeated contact with a material having a weaker attraction, electrons move to the stronger material. This creates a build-up of negative charges (electrons) on the stronger material and a positive charge on the weaker due to its electron deficit. When these static charges "jump" or discharge onto another material (e.g. a doorknob), you experience a shock.

Gravitational forces are attractive forces only between two objects. They exist between everything throughout the universe. You are currently experiencing a gravitational attraction (albeit a very weak attraction) with the Sun, which is 150,000,000 million km away. The best known of such forces is that between the Earth and everything on or orbiting around it (e.g. people, the moon). The strength of the gravitational force felt by objects is reliant on the masses of each object and the distance between the objects. Each object's gravitational force radiates outward in all directions infinitely, but its strength rapidly falls off with distance due to the inverse square law ($1/x^2$). The inverse square law states that the force of attraction between two objects is increased or decreased by 1 over the square of the distance between them. If you doubled your distance, the force of attraction would be $1/2^2$ or $1/4$ as strong. If you halved the distance, the force of attraction would become $1/0.5^2$ or twice as strong. Gravitational forces between you and the Earth determine how much you weigh. Each planet's gravitational force is different. Therefore, you would not weigh the same on Neptune as you do on Earth. If there is



Astronauts experience feelings of weightlessness in space because they and the ship they are in are both in free fall at the same speed.

gravity everywhere at all times, why do astronauts experience "weightlessness" in space? Although it appears that this is true, what they are actually experiencing is a lack of apparent gravity. In the case of a ship orbiting around the Earth, this apparent lack of gravity is due to Earth's gravity pulling both the astronauts and the ship at the exact same rate towards the Earth. Both move towards the Earth at the same speed. This apparent lack of gravity causes the astronauts to float within the ship. This is similar to the effect felt when descending rapidly on a roller coaster or in an elevator. You and the car/elevator are falling at the same speed and for a moment, you experience weightlessness.

How are these forces used?



Compasses use Earth's geomagnetic field to determine direction.

Magnetic forces are used in a variety of everyday applications, including **compasses**, **burglar alarms**, and **magnetic resonance imaging (MRI)**. **Compasses** used to find direction take advantage of Earth's own magnetism, called the **geomagnetic field**. Scientists believe this field is due to a giant molten iron core spanning about half of Earth's diameter that gives off powerful magnetic currents that can be picked up by ferromagnets. Some **burglar alarm** systems use magnets to activate the alarm. A magnet is placed in a door frame, for example, and in the door itself. When the door is opened, it disrupts the magnetic field, setting off the alarm. **Magnetic resonance imaging (MRI)** is used to look within a person's body without having to open them up or bombard them with potentially dangerous X-rays. MRIs have a magnetic field that affects atoms inside the body, making them spin at specific frequencies. Radio signals set to the same frequency as atoms in cells of interest (e.g. tumor cells) are sent into the body and the cells absorb their energy. When the magnetic field and radio signals are turned off, a computer scans the body for emission of those specific frequencies of energy and creates a three-dimensional image for doctors to investigate.



Copiers use electrostatic forces.

Electrostatic forces also have several useful applications, including in **copy machines**, **laser printers**, and **air cleaners**. **Copy machines** work by using a method called **xerography**. A positive charge is first sprayed onto a surface coated with **selenium**. Selenium reacts differently to darkness and light, insulating against charges in the dark and conducting charges in light. Next,

a negative charge is applied to the selenium surface beneath the positive charge. This then exposed to the image that is being copied and light is shone through the image. In the image through which light shines, the selenium conducts the underlying negative charge, creating a neutral zone. In the parts of the image that remain dark, the selenium insulates the negative charges, maintaining the positive charge to transfer the image. Next, negatively charged ink particles are sprayed onto the surface, where they attach to the positive image space. Paper is fed through the machine and across the charged surface. This paper has a greater positive charge than the selenium-coated surface, and so pulls the ink off the surface before being fed through hot rollers that melt the ink into the paper. **Laser printers** work the same way as copiers. The only difference is that the image is transferred to the selenium-coated surface from a computer using lasers. After the image has been created on the selenium, the printing process follows the same xerography procedure. **Air cleaners** generally apply a positive charge to pollutant particles (e.g. smoke, dust, pollen) before passing air through an oppositely charged mesh filter. This filter attracts the charged particles, cleaning the air of irritants and allergens. Such electrostatic air cleaners are used in industrial plants as well as in homes.



Roller coasters are powered by gravity.

Gravitational forces are necessary for life on Earth and for many other things. Gravity is applied to things like space exploration and recreation. Gravity keeps spaceships **in orbit**, and **roller coasters**. Without gravity, everything on the Earth would float out into space. Things like we and every other organism on Earth could not lead our lives without **Earth's gravitation**. Similarly, we can send ships and satellites into space. They stay in space because Earth's gravity holds them safely in **orbit**. The momentum of the ship or satellite (its tendency to keep moving in a straight path) must balance the pull of gravity so that it does not crash to Earth. This balance keeps the object moving sideways as it slowly falls towards the planet, but never crashing into it. Finally, **roller coasters** are powered by gravity; they don't have a motor. A chain pulls the roller coaster car up the first hill in the track, where it lets go and the acceleration due to gravity keeps it moving along the rest of the track. This is because the car gains potential energy as it is raised. When it is released, that potential energy is converted into kinetic energy (the energy of motion).

The higher the first hill, the more potential energy is stored. This means that the higher the first hill, the longer the roller coaster can be.

Reading Comprehension Questions:

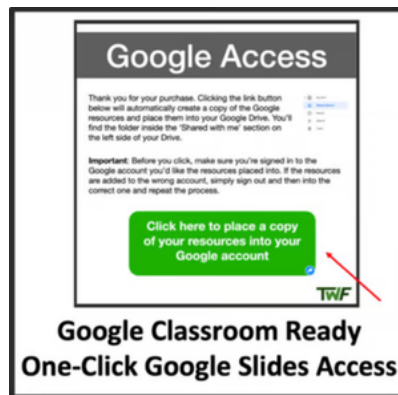
1. What is magnetism?
2. What are the three types of magnetic forces?
3. What factors determine the strength of electrostatic forces?
4. Why do you receive an electric shock when you touch a doorknob after walking across a carpeted floor?
5. What are gravitational forces?
6. Name three everyday applications of magnetism.
7. What is the method by which copiers and printers transfer images to paper?
8. Why is gravity essential to life on Earth?

Extension Questions:

9. Why is the term "zero gravity" misleading? Why doesn't gravity cause the ship to crash onto the surface?
10. Research Coulomb's Law. How would you determine the magnitude of an electrostatic force?
11. How do birds and other migratory animals find their way over incredibly long distances? What biological factor do they possess that allows them to do this?

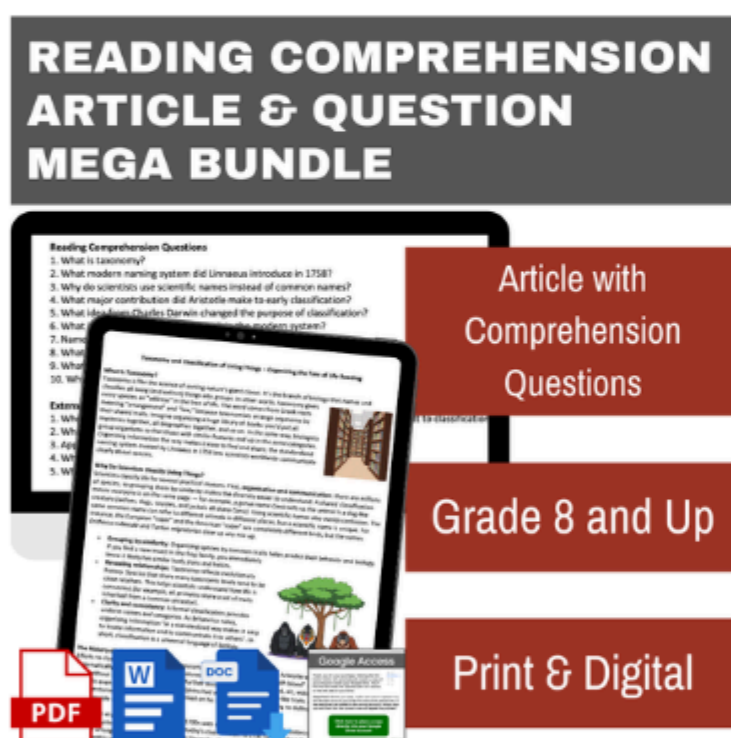
Full Answer Key

Comprehension and Extension Questions



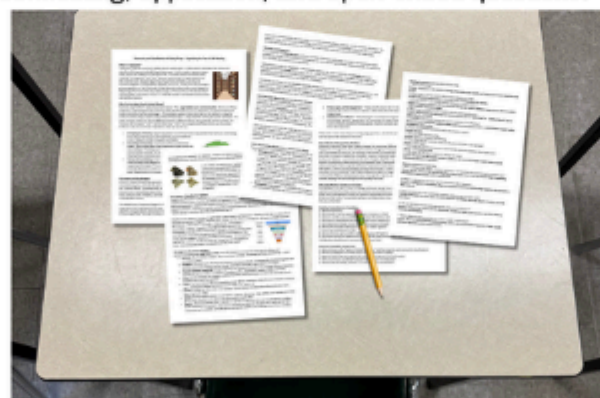
Upgrade to the Grade 8 and Up Reading Mega Bundle

Includes over 150 readings for students in grades 8 and up. The bundle covers all science topics and will save you over 80%.



CLASSROOM READY

- Questions and Answer Key
- **No Prep, Ready-to-Use:** Print or assign digitally with Google Docs, Microsoft Word, and PDF formats for flexible classroom use
- **Includes Varied Question Types:** Knowledge, thinking, connecting, application, and open-ended questions.



★★★★★ Extremely satisfied - It is a good supplemental activity either for review and at the same time introducing some concept. I also use this for sub plan. It is well presented, organized and interesting.

★★★★★ Extremely satisfied - This a great resource. I used this for a sub plan. It was fun and engaging for my students.

Grade 8 and Up Scientific Reading Comprehension Article Mega Bundle

ALL my current and future grade 8 and up readings, covering the following subject areas:

Biology
Chemistry
Earth and Space
Ecology and the Environment
Energy
Health
Natural Disasters
Physics



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