



CLASSROOM ACTIVITY

WORLD OF FORCE FIELDS

Have you ever considered what our world would be like if it was not governed by the normal laws of physics?

In this activity, you and your peers will enter the world of video games as you create an idea for a game that incorporates force fields to enhance the user's experience.

STEP 1: CONNECT

The concept of a “force field” often refers to inventions or universes that do not adhere to the laws of physics as we know them. Find two teammates and form a group of three. Then, discuss: What books, movies, comics, or games have you read, seen, or played that incorporate the idea of force fields? How?

STEP 2: INVESTIGATE

Three of Earth's main force fields are magnetic fields, electrical fields, and gravitational fields.

Divide these force fields among you and your teammates. Then, each team member will become an expert on that force by consulting the following sources. Be ready to share what you have learned.

- **Magnetic Force Field Expert:**
 - Read this description: <https://tinyurl.com/magneticexpert>
 - Then interact with this simulation: <https://tinyurl.com/magneticexpert2>
- **Electrical Force Field Expert:**
 - Read this overview: <https://tinyurl.com/electricalexpert>
 - Then explore this interactive: <https://tinyurl.com/electricalexpert2>
- **Gravitational Force Field Expert**
 - Watch this video: <https://tinyurl.com/gravitationalexpert>
 - Then experiment with this simulation: <https://tinyurl.com/gravitationalexpert2>

STEP 3: DISCUSS

Take turns sharing what you each learned about your force fields.

Be sure to discuss:

- **Magnetic Force Field:** What is a magnet? Why can a magnet exert force over a distance? How do the magnetic fields of two magnets interact when they are brought close to each other?
- **Electrical Force Field:** What is an electric field? Why does an electric field exert force over a distance? How do electric fields interact when charges are brought close to each other?
- **Gravitational Force Field:** What is a gravitational field? Why can a gravitational field exert force over a distance? What is Newton's Law of Gravitation and how does it describe the interaction between two masses within each other's gravitational fields?

STEP 4: MATERIALS

Now apply what you have learned as you brainstorm ideas for your own video game!

You'll need:

- Device with internet access
- Device with recording capabilities
- Paper and drawing supplies or use of [Canva](#) (to create a digital storyboard)

STEP 5: THE CHALLENGE

Your team's challenge is to create a paper or digital storyboard for one level of a new video game that incorporates each of the forces you researched: Magnetic, Electrical, and Gravitational.

First, brainstorm the premise for your overall game. Where will it take place? Who will the characters be? What will the characters try to achieve? Then, narrow down your game to one level. Discuss the challenge that players will encounter during this level, being sure to consider how each of the forces could be incorporated.

Finally, create a storyboard (*think: comic strip!*) using either paper divided into squares or a digital design tool like [Canva](#). Segment your video game level into key parts, and illustrate or explain each part in its own storyboard square. Include details about each section, being sure to include each type of force in the gameplay.

STEP 6: SHARE

Create a video that showcases your video game idea. Use your storyboard to explain what will happen in the game level you developed and explain how each of the force fields will contribute to the overall user experience. Post your video with the hashtags #InnovationatPlay and #WorldofForceFields so others can learn from it, too!

ADD A HEADSET!

Mixed reality headsets use magnetometers, which are special sensors that measure magnetic fields to help understand how the user is moving or turning their head. By sensing the Earth's magnetic field, these headsets can figure out how they are oriented, which makes their movements in the virtual world more accurate and realistic.

Can you incorporate headset use into your game design?

NGSS STANDARDS

- Disciplinary Core Idea: PS2.B: Types of Interactions
 - Newton’s Law of Universal Gravitation and Coulomb’s Law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects.
 - Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields.
- HS-PS3-5: Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

COMMON CORE ELA STANDARDS

- CCSS.ELA-LITERACY.CCRA.SL.4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.