

# Episode 3: Electric Motorcycles and the Future of Sustainable Transportation

8th Grade Science

## Summary

In this episode, Scott discusses the concept of fields—gravitational, electric, and magnetic—by explaining how they interact and impact objects. He also touches on electromagnetism and forces in motion, giving real-world examples of how forces are applied in the development of technology like electric vehicles.

## Objective:

- Students will learn to understand and explain the concept of fields (gravitational, electric, and magnetic) and their effect on forces, motion, and energy transfer.
- They will investigate how these fields apply to real-world technology, such as electric vehicles, and apply this understanding to force diagrams and the relationship between electricity and magnetism.

## Key Concepts:

1. **Gravitational Force** - Force that attracts two objects with mass toward each other.
  2. **Electric Fields** - Areas around charged objects where electric forces are exerted.
  3. **Magnetic Fields** - Regions around magnets where magnetic forces are exerted.
  4. **Electromagnetism** - The relationship between electricity and magnetism, where electric currents create magnetic fields and vice versa.
  5. **Unbalanced Forces** - Forces acting on an object that change its motion, leading to acceleration or deceleration.
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## Key Vocabulary:

1. **Gravitational Force** - A force that pulls objects toward the center of mass.
2. **Electric Field** - The region around a charged object where it exerts electric forces.
3. **Magnetic Field** - The area around a magnet in which magnetic forces act.
4. **Electromagnetic Force** - A force that occurs when electric current creates a magnetic field.
5. **Force Diagram** - A diagram showing all the forces acting on an object.
6. **Friction** - A force that resists the sliding or rolling of an object across a surface.

## Pre-Video Discussion Questions:

1. **What are some examples of forces that affect the motion of objects in your everyday life?**
  - *Discussion Point:* Help students identify forces they encounter, like gravity, friction, or magnetic forces (e.g., fridge magnets).
2. **How does the concept of a "field" help explain why objects move or change direction?**
  - *Discussion Point:* Clarify that fields are invisible forces that influence objects even if we can't directly see them, like gravity or electric fields.
3. **Can you think of any technology that uses electromagnetism?**
  - *Discussion Point:* Encourage students to think of examples like motors, electric vehicles, or even speakers, where electromagnetism plays a key role.
4. **What happens when multiple forces act on an object at the same time? How can we predict its movement?**
  - *Discussion Point:* Introduce the idea of force diagrams and how they can help predict the resulting motion of an object.

## Activity:

### Objective:

Students will create a force diagram to model the motion of a car (or any object) experiencing multiple forces, including gravitational, frictional, and magnetic (if applicable).

### Materials:

- Paper
- Rulers
- Pencils
- Examples of objects (toy cars, balls, etc.)
- Force diagrams worksheet (optional)

## Instructions:

1. Begin by discussing how forces affect the movement of objects. Introduce the force diagram, explaining that forces have both magnitude and direction.
2. Provide students with a scenario (e.g., a toy car on a ramp with friction, gravity, and an applied force).
3. Have students draw the object and label the forces acting on it. Make sure they identify balanced or unbalanced forces.
4. Discuss the results as a class. If forces are unbalanced, what happens to the object's motion?

## Analysis:

- How does the interaction of forces determine the motion of an object?
- In what ways are electric, magnetic, and gravitational fields similar or different in terms of how they affect objects?
- How can the concept of force diagrams be used in everyday technology (like electric vehicles)?

## Extension Activities:

1. **Investigate Electromagnetic Fields:**  
Build a simple electromagnet using wire and a battery. Have students measure how the strength of the magnet changes with the number of coils or the type of wire used. Discuss how electromagnets relate to the forces acting on electric vehicles.
2. **Explore Gravitational Forces:**  
Use an interactive simulation to show how gravity works with different masses. Have students measure the force of gravity on various objects and how it changes with distance (e.g., Earth's gravity vs. the moon's gravity).
3. **Magnetic Field Mapping:**  
Have students map the magnetic field of a magnet using iron filings or an online simulation. Discuss how magnetic fields are used in technology like motors and electric cars.

## Post-Video Discussion Questions (with answers):

1. **How does gravity affect the motion of objects on Earth?**

**Answer:** Gravity pulls objects toward the center of the Earth, causing them to fall when unsupported. It also determines weight, which varies with location.

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2. **What happens when two objects with opposite charges are placed near each other?**

**Answer:** Opposite charges attract each other, while like charges repel.

3. **In what ways can electric fields and magnetic fields interact?**

**Answer:** Moving electric charges (electric currents) create magnetic fields, and changing magnetic fields can induce electric currents, as seen in electric motors and generators.

4. **How can we use force diagrams to predict the motion of an object?**

**Answer:** Force diagrams show all the forces acting on an object, helping to predict its motion. If the forces are unbalanced, the object will accelerate in the direction of the net force.

