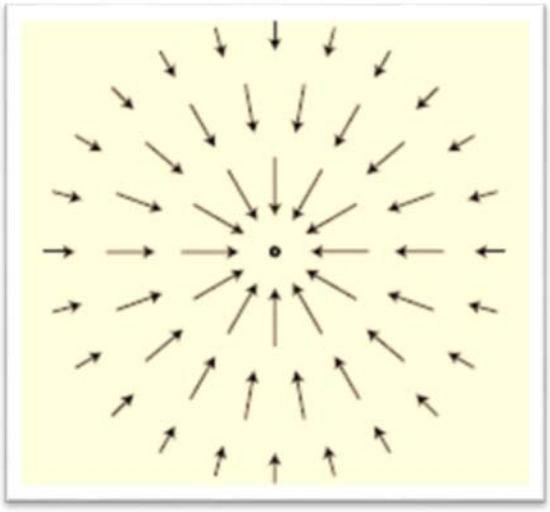
FORCES AT A DISTANCE



Unit Introduction

There are two types of forces—contact forces and forces acting from a distance. This unit will focus on forces at a distance.

Forces at a Distance

There are different types of forces that can act on objects from a distance. Some of these forces are gravity, electricity, and magnetism.

Gravitational forces are forces of attraction between objects that are due to their masses. An object's force of gravity has the tendency to pull other objects toward it. The larger the object, the more gravity the object has. Planets are very large and thusly have great amounts of gravity. A pencil, in comparison, is tiny and only has a minimal amount of gravity. Any object with mass, no matter how small, has gravity.

Learn more about gravitational attraction by reading the following article.

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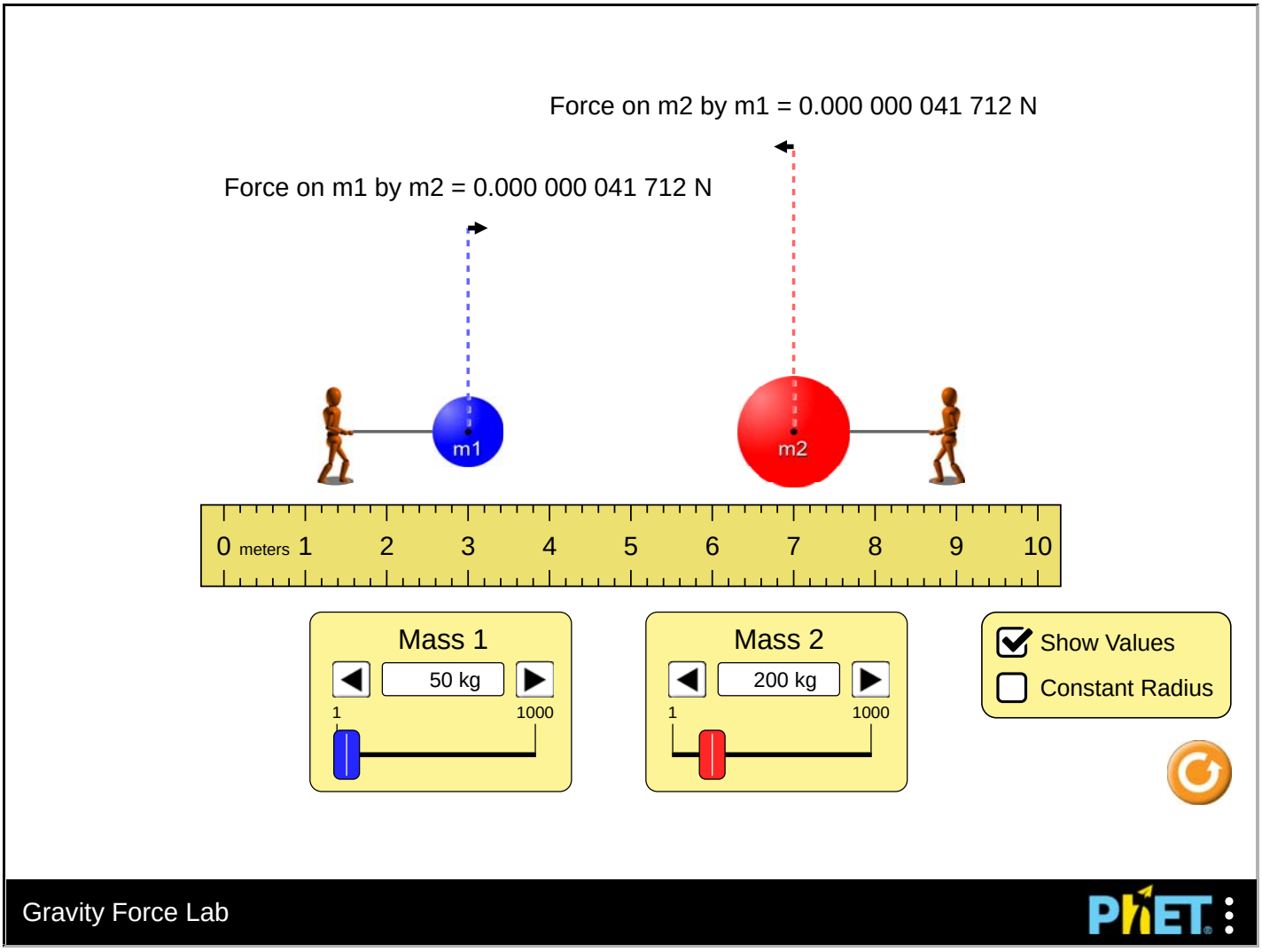
PhET Simulation: Gravity Force Lab

To explore the attractive force of gravity, interact with the following simulation. Complete the activity as you explore the sim. Submit your work as question #12 in the assessment portion of the unit.



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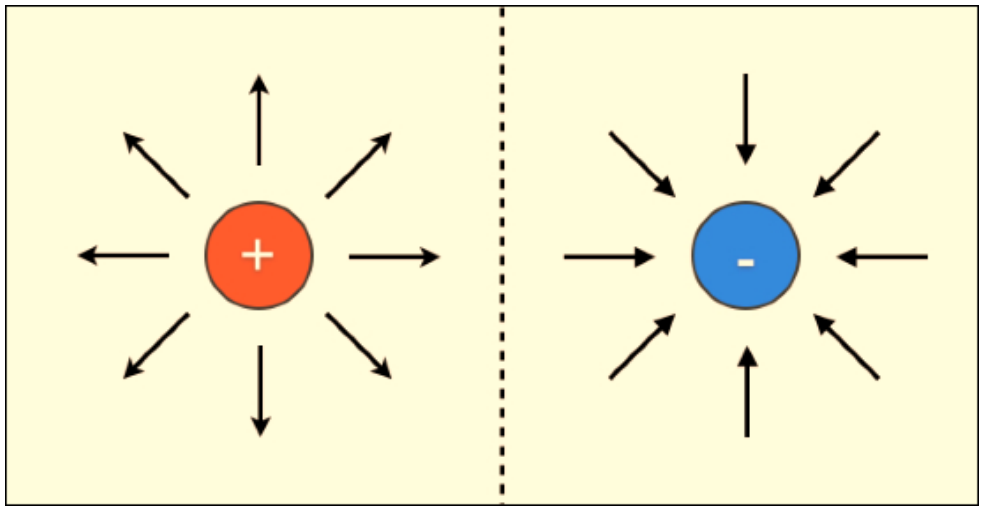
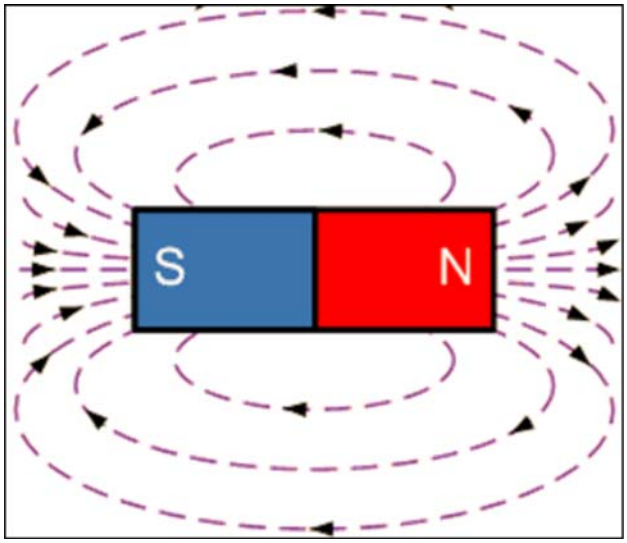
Electric forces exist between charged particles. Like charges will repel each other and opposite charges will attract one another. As the distance increases between charges, the electric forces get weaker. As the charged particles move closer together, the electric forces are stronger. Coulomb tested and proved this theory with his work. Watch the following video for a thorough explanation of Coulomb's law and electric forces.

Coulomb's Law | Electrostatics | Electrical engineering | Khan Academy



Magnetic forces occur when charged particles are in motion. If particles move in the same direction, there is an attraction. If particles move in opposite directions, there is a repulsion. Read the following article to help you further understand magnetic forces.



What is a Field?

A ***field*** is a region of space that has a certain quantity of something throughout that space. A simple way to think of this is that an object can have an area around it that is affected by that force. The following website has basic information related to the field concept.

http://www.physics4kids.com/files/elec_field.html

One type of field is a gravitational field. A gravitational field has the same force of gravity throughout the field. The force from Earth's gravitational field, if you are on or near Earth's surface, is $9.8 m/s^2$ downward. This force is used to calculate an object's weight that is resting on the surface of Earth.

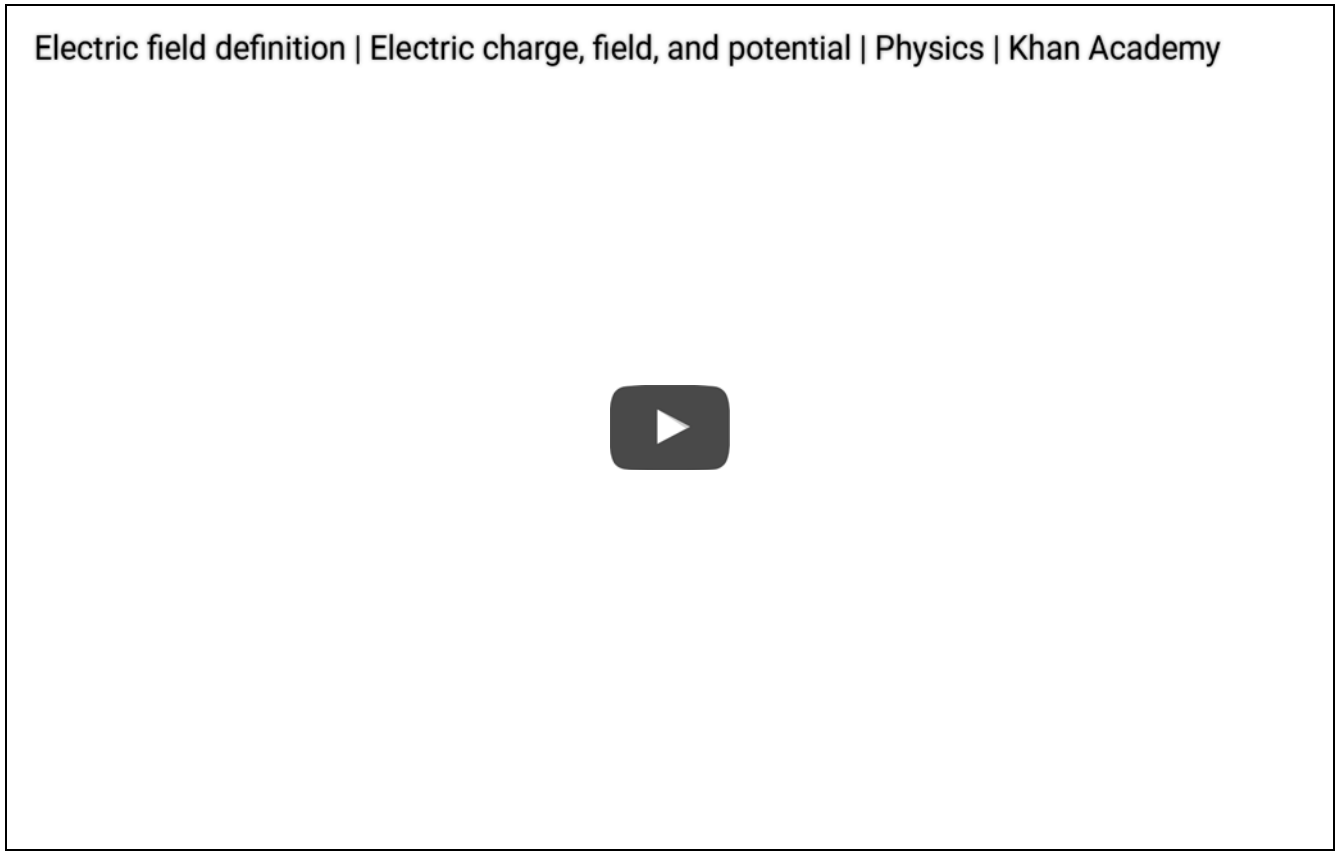
A person sitting in a chair is resting on Earth's surface and is subject to Earth's gravitational field. If the person has a mass of 40 kg and is subject to a gravitational force of $9.8 m/s^2$, then the person's weight is 392N.

Learn more about Earth's gravitational field from watching the following video clip.

Viewing g as the value of Earth's gravitational field near the surface | Khan Academy

Similarly, electric and magnetic fields exist. Scientists knew the electric forces existed but were puzzled as to how they were transmitted. A physicist named Michael Faraday proposed that a charged particle will create an electrically charged field all around it at all times, and the charge gets weaker the further it is from the source. If another charged particle comes into this field, it will be moved around depending on that particle's charge.

This video clip further defines the electric field. Simply put in the video, electric field is the way electric charges talk to each other, and it is defined as amount of force per charge. Watch for more helpful information.



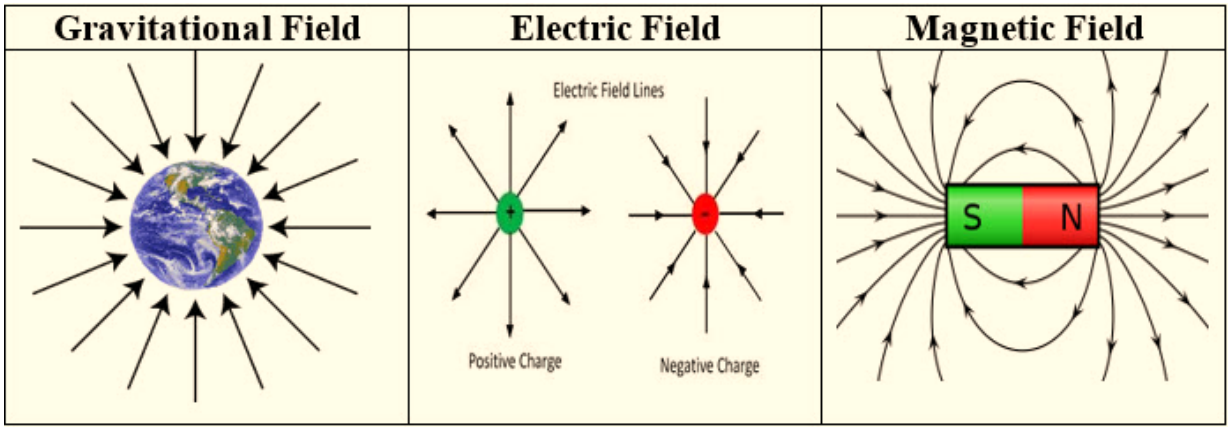
Here is a website that shows how to draw the electric field lines:

http://www.physicsclassroom.com/class/estatics/Lesson-4/Electric-Field-Lines

A magnetic field is a way to show how the magnetic force is distributed around a magnetic object through space. You can use either a compass grid pattern or vector field lines to illustrate a magnetic field. Magnetic fields occur wherever a charge is in motion. For more information on magnetic fields please read the following website.

KHANACADEMY

What do the vector lines look like for each type of field? Consult the chart below.



For all types of fields mentioned above, the stronger the field is, the more force it will have on an object in that field. Even if the object is not interacting with anything else, the field around that object still exists.

Discovery Education: Electric and Magnetic Fields

The next video provides detailed analyses and depictions of key concepts related to electric and magnetic fields. The program explores electric charges, electric fields and field lines, electric motors, electromagnetic force, electromagnetic induction, gold leaf electroscopes, Faraday's law of induction, Fleming's left and right hand rules, and magnetic declination.

QuickTime Electric and Magnetic Fields (33:31)

PhET Simulation: Electric Field Hockey

Interact with the following simulation to further explore the effects of charged particles and forces in the electric field. Complete the activity and submit as question #13 in the assessment portion of the unit.

https://phet.colorado.edu/en/simulation/legacy/electric-hockey

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QUIZLET VOCABULARY

Quizlet

Now and questions 1 through 13.