PHYSICS IN MOTION
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Unit 6F
Electromagnetic Wave Properties
Properties of Electromagnetic Waves Lab

Name:

Date:

In this activity, you will examine several properties of electromagnetic waves, including reflection, refraction, and the photoelectric effect.

Part One: The Law of Reflection

Investigate the law of reflection with a plane mirror.

Materials:

- flat mirror
- thumbtack
- protractor
- ruler
- paper

Procedure:

1. Place a flat mirror along the edge of the paper.
2. Push the thumbtack into the paper to one side of the mirror.
3. Looking into the mirror at an angle so that you see a reflected image of the thumbtack, use your ruler to trace a line from the mirror to the reflected image. This is the line of reflection.
4. Repeat this procedure, looking at the reflection of the thumbtack from a different angle.
5. Trace a line from the thumbtack to where the line of reflection intersects the edge of the paper. This is the line of incidence.
6. Trace a line straight across the page from where the lines of incidence and reflection intersect. This is the normal line.
7. Using a protractor, measure the angle between the normal line and the line of incidence. This is the angle of incidence.

   angle of incidence = _____

8. Measure the angle between the normal line and the line of reflection. This is the angle of reflection.

   angle of reflection = _____

9. How do the angle of incidence and the angle of reflection compare to each other?
10. Repeat for the other lines of incidence and reflection.

    angle of incidence = _____

    angle of reflection = _____

11. How do the angles between the normal line and the lines of incidence and reflection compare to each other?

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Part Two: Refraction

Investigate the refraction of light.

Materials:

- opaque cup
- clear cup
- water
- penny
- straws (2)
- pencil

Procedure:

1. Place the penny in the bottom of the opaque cup near the edge. Look into the cup from the same side that the penny is located. Can you see the penny?

2. Slowly pour water into the cup and look into the cup from the same angle as before. Can you see the penny? Draw a diagram.

3. Does the penny move as water is added to the cup or does it just become visible? Explain.

4. Place the pencil in the clear cup. Look at the pencil from the side. How does it appear?

5. Slowly pour water into the cup. How does the pencil now appear from the side view? Draw a diagram.

6. Does the appearance of the pencil help explain what happened with the image of the penny?

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Part Three: Photoelectric Effect

This portion of the lab will be conducted virtually, using the Photoelectric Effect simulation by PhET. You can access this simulation at https://phet.colorado.edu/en/simulation/photoelectric.

Procedure:

1. **Begin with sodium as the initial target material, and set the light shown upon it at a wavelength of 400 nm. The particles emitted by the sodium are electrons. Slowly increase the intensity of the light. What happens to the number of electrons emitted as light intensity increases?**

2. **Adjust the light wavelength slide. Do all wavelengths cause electrons to be emitted? Do some wavelengths cause more electrons to be emitted? Use the Current reading to make your determination.**

3. **Change the target to different materials. Does the same range of light wavelengths cause electrons to be emitted from all target materials? Why do you think this is?**

Courtesy of:
PhET Interactive Simulations
University of Colorado Boulder
https://phet.colorado.edu