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

Name:

Date:

In today's activity, you will be examining 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. To one side of the mirror, place the thumbtack into the paper.
3. Look at an angle into the mirror so that you see the reflection of the thumbtack. Using the ruler, trace a line from the mirror along the line at which you are seeing the reflection. This is your line of reflection.
4. Repeat again, looking at the reflection of the thumbtack from a different angle.
5. Draw a line from the thumbtack to where the line of reflection intersects with the edge of the paper. This is the line of incidence.
6. Next, draw a line from where the lines of incidence and reflection intersect straight across the page. This is the normal line.
7. Using the protractor, measure the angle between the normal line and the line of incidence This is the angle of incidence.

   Angle of incidence = _____

8. Next 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 angle of reflection compare to one another?

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 these two lines compare?

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Part Two: Refraction

Investigate the refraction of light.

Materials:

- opaque cup
- clear cup
- water
- penny
- two straws
- pencil

Procedure:

1. Place the penny in the bottom of the opaque cup near the edge of the cup. Look into the cup from the same side 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. What is happening to the image of the penny? Draw a diagram.

3. Does the penny move as water is added into the cup, or does it just become visible? Explain what must be happening.

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

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

6. Does the way the pencil looks when water is in the cup explain why the penny appeared when water is poured into the cup?

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Part Three: Photoelectric Effect

This portion of the lab will be conducted virtually, using the PhET simulation called Photoelectric Effect.

You can access this simulation at https://phet.colorado.edu/en/simulation/photoelectric.

Procedure:

1. **The initial setting has Sodium as the material that is the target having light with a wavelength of 400 nm shown upon it. Slowly increase the intensity of the light. The particles being emitted by the Sodium are electrons. What happens to the number of electrons emitted as the intensity of light increases?**

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

3. **Change the target to different materials. Do they all have the same range of light that cause electrons to be emitted? Why do you think this is?**

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