Name: ________________________ Class: ___________ Date: _______________

# Refraction Lab: From Air to solids

**Learner Outcomes:**

- Investigate, measure and describe the refraction of light through different materials

**Key Terms:**

| | | |
|---|---|---|
| Refraction | Angle of incidence | Parallax |
| Normal | Angle of refraction | Point of incidence |

**Background Information:** When light travels at an angle from one medium (substance) to another, it bends or refracts due to changes in the speed of light. When light hits a different medium with a different density, particles slow down the speed of light. When part of a beam of light slows down and the rest keeps going, the beam of light will bend.

**Research Question:** What happens to light when it passes from air through different transparent solids?

**Hypothesis:**

_____________________________________________________________________

→ *your hypothesis should answer the problem above and explain why*

**Experimental Design:**

Manipulated Variable –

Responding Variable –

Controlled Variables -

**Materials:**

| | | |
|---|---|---|
| Glass block | protractor | transparent plastic |
| paper | ruler ray box with | block |
| pencil | single slit | |

This investigation / activity has been adapted from:
Mah K, Martha J, McClelland L, et al. *Science in Action 9.* Toronto, ON: Addison Wesley.

**Procedure:**

1. Place a glass block on a piece of paper and trace around it. Mark a point near the middle of the front edge and draw a *normal* at right angles to this point.
2. Direct a ray of light from the ray box so that it shines along the normal. The point where the ray enters the block is the *point of incidence*.
3. Mark the exit point where the ray leaves the glass. Join the incident and the exit points. This is the *refracted ray*.
4. Adjust the ray box so that the light strikes the glass at the same point of incidence, but this time at an angle from the normal. Measure and record the angles these *angles of incidence*.
5. Again, trace the incident ray and mark the point where it leaves the block. Draw and label the refracted ray in a different color.
6. Repeat steps 4 and 5, two more times, each time using different angles for the incident ray.
7. Start with a fresh sheet of paper and repeat steps 1-6 using the same angles of incidence as you used for the glass block. (You will need to have measured them).
8. Complete each refracted ray on the paper using a ruler to join the point of incidence to the exit point. Make sure all rays, incident and refracted are labeled correctly. Measure each angle with a protractor and then record their values in your data table. Add arrows to indicate their direction.

**Observations:**

**Refraction from Air to Glass**

| **Ray Color** | **Angle of Incidence** | **Angle of Refraction** |
|---|---|---|
| | 0 (along the normal) | |
| | | |
| | | |

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| | | |
|---|---|---|
| | | |

## Refraction from Air to Plastic

| Ray Color | Angle of Incidence | Angle of Refraction |
|---|---|---|
| | 0 (along the normal) | |
| | | |
| | | |
| | | |

**Analysis:**

1. What happened when the light ray entered the glass block along the normal? What happened with the plastic block?

2. What happened when the angle of incidence was increased?

3. How does the angle of incidence compare with the angle of refraction?

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4. How did the refraction of rays in glass and plastic compare? Which refracts light more?

5. What two factors affect how much light is refracted?

**Conclusions:** What generalization can you make about what happens to light when it passes from air through transparent solids?

**Extension:**

1. Have you ever been on a car trip on a hot sunny day and the road ahead seems wet? What you are seeing is an optical illusion called a mirage. Investigate the role refraction plays in causing mirages.
2. Investigate, describe and explain one natural situation where refraction could be a problem for animals acquiring food. Research how the animal overcomes the problem of refraction.

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