Teacher Notes: Full of Hot Air?

Introduction

Go over the introduction with students. Be sure they understand the concepts of refraction and medium. A good way to lead into this lab is to discuss the twinkling of stars in the night sky.

You can also relate this to **convection**. Convection is the method of heat transfer. It does not require direct contact, only some substance (liquid or gas) to transfer the heat. A good resource on convection is *Convection: A Current Event* by Alan Gould, published by Lawrence Hall of Science.

Light has many interesting aspects. **Refraction** is the way that light bends as it travels through different mediums. The **medium** is the substance that light is traveling through. If you are looking at the Moon while standing by a pool, the medium is air. If you are looking at the Moon from under water after you jump into the pool, the mediums are both air and water. The Moon would appear different from underwater because the light is refracted.

In this experiment you are going to decide if warm air and cool air are considered to be different mediums, or if they are the same medium.

Materials

Clay
Candle (any size)
Laser pointer
Binder clip
White paper (8.5 x 11")
Masking or transparent tape
Styrofoam cup
Meter stick

Procedure

I: Cool Air

1. Tape the white paper to a wall.

2. Measure a distance of 1.10 meter from the paper.

3. Place the cup at this mark.

4. Turn the laser on. **Never look directly at the laser beam or allow it to shine in someone's eyes.** Use the binder clip to maintain the laser pointer in the ON position.

5. Place the laser pointer on top of the cup.

6. Observe the point of light that is formed on the white paper. Record your observations in a data table. Turn off the laser. Have students construct the data tables in your preferred format.

II: Hot Air

1. Tape the white paper to a wall.

2. Measure a distance of 1 meter from the paper.

3. Imbed the candle into the clay. . If you have another means of keeping the candle in place that you prefer, use that.

4. Set the candle in clay at the 1-meter mark. Be sure it is 1 meter, not 1.10 meter like in Part 1.

5. Measure a distance of 10 cm from the candle in clay. The purpose of this is to keep the laser pointer at the same distance for both parts so distance is controlled.

6. Place the cup at this mark.

7. Light the candle.

8. Allow the candle to burn for 2 minutes. **Be careful with the fire!** The effect is not instant. You have to let the candle burn a little to heat up the air.

9. Place the laser pointer on top of the cup in the ON position.

10. After 2 minutes, observe the point of light that is on the white paper. Record your observations in a data table.

12. Blow out the candle. Observe the effects of the smoke on the laser. Record

your observations in a data table. Turn off the laser.

Questions

1. What did the point of light look like when it went through cool air?

When the point of light went through cool air, it looked like a steady point of light.

2. What did the point of light look like when it went through hot air?

When the point of light went through warm air, little light rays seemed to shoot off the point, and they moved any time the candle flame moved.

3. Can you relate this to stars in the night sky and our atmosphere?

The laser beam is like light from a star. The air between the "star" and the paper is like our atmosphere; our atmosphere is warmer than outer space. As the light from the star travels, it is passing through cold space. Once it enters our atmosphere, it is passing through warm air. These are two different mediums, so the star will appear differently.

4. Describe what happened after you blew out the candle. Why did this happen?

When the candle is blown out, the smoke makes the laser beam visible. The smoke from the candle creates another medium. The laser light will be refracted and become easy to see since it behaves differently in different mediums/

**You can also have students answer questions about convection and how that relates to the activity.

Conclusion

Are warm air and cool air considered to be different mediums, or are they the same medium? Use evidence from your lab to backup your claim.

Warm air and cool air act like different mediums. The laser beam moved and twinkled in the warm air, but not in the cool air.