

Interactive Notes-“Light and Water”

Materials (per group of 2 students):

Demo 1	1-opaque or other cup that cannot be seen through 1-penny 1-large beaker (600-mL ideal) ½ full of water
Demo 2	(<i>penny & beaker again</i>)
Demo 3	1-pen or pencil
Demo 4	1-“Physics!” sign with red and green letters 1-small Erlenmeyer flask with just enough red-colored water to cover the bottom of it 1-red and green colored pencil (optional)
...and	4-note sheets (see last page) Towels to clean up spills with

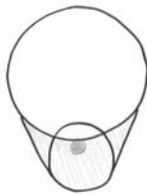
Additionally- PowerPoint (see last page)

Normally these demonstrations are done in groups of 4 students. But today’s demonstrations are all so simple and quick they can be done in pairs. This also gives each student more opportunity to do more hands-on stuff.

Beforehand:

- Put the red colored water in the Erlenmeyer flasks.
- Set out all materials *the day before*. Leave yourself time to realize you’re missing something, and to practice a new demonstration, research something or even make a change. In the morning, read through the slides and notes one last time. Relax and have fun along with your students. Remember- you’re only as effective as your plan.
- Insert page and paragraph numbers from relevant pages in your textbook at the bottom of slides 1 and 2 if you choose to have the class read from it together. This is a good way to connect with your textbook as well as transition into the next demo. You can also delete these page inserts, or Copy and Paste them onto later slides if needed.
- Print extra copies of the notes pages on paper for yourself, students that are slow writers or can’t see well, and for absentees. Click “File” → “Print” → then where it says “Print what:“ select “Handouts” → and then “OK”.
- As with any other demonstration, try these out ahead of time for yourself so you know how they work best and so you know what to expect.

Interactive Notes: Light & Water



Do: Placed a coin in bottom of cup just out of view. Added water.

See: The coin appeared slowly until it was completely visible!

What's Happening: Light bends (*refracts*) as it moves between water and air because it's changing speeds. Light moves through air at 186,000 mi/sec and through water at 140,000 mi/sec.

1.

Read p. 1 together

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Students will do this in pairs. Student #1 is the “sitter” and the other the “pourer”. Tell the sitter to put the penny in the bottom of the cup and then, without moving their head, push the cup away until the penny is just barely out of sight. Then, while the sitter stays perfectly still, have the pourer pour water from a beaker *very slowly* into the cup, being careful not to slosh the penny around. As the cup fills, the penny will slowly appear!

If it didn't work, have them redo until it works. After it's successful, have them switch so the other can see the effect.

To help students understand refraction, have a volunteer walk across the classroom in a straight line. That represents a light ray moving through just one type of medium- like air, water, or glass. Then have the volunteer start across again, except this time when they're halfway across tell them to suddenly change direction, angling off. When they changed course it was like a light ray moving between 2 mediums of different densities, which causes bending of the light. Light bends when the medium it's going through changes. In this demonstration the person's head didn't move, but the light bent when it left the water and entered air.

A fun thought to go along with this- imagine yourself standing above a clear stream looking at fish. Are they really there, or are they ahead of or behind where they appear to be? If you were spear fishing, where would you throw the spear?

2.



Do: Placed a coin beneath a beaker. Added water. Looked through the side then across the top.

See: At first the penny disappeared. Then there were two.

What's Happening: Light is bending, and this time some of it **reflects** back into the water since it has a higher density than air.

Read p. 1 together

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For this one students need a penny, an empty beaker and a cup of water. Have student #2 dry the penny and the bottom of the beaker, and then set the glass beaker *on top* of the penny. Now tell them to pour water into the beaker while looking at the penny through the side of the beaker. The penny slowly disappears. But when they look across the top of the water at the back of the beaker, there's a reflection of the penny. Look straight down and there's the penny again. Now there are 2!

If you'd like to attempt a little humor, talk about how powerful of a magician you are. Before they pour the water, tell them that on your command the penny will disappear. But it will only work if everyone in the room believes in you. When the pennies disappear take all the credit. To really get them going, pull some pennies out of your pocket, as if that's where they all went.

Make sure the penny is dry before placing the beaker on it. A wet penny will not disappear.

3.



Do: Placed a pencil into water.

See: It separated and enlarged.

What's Happening: **Density** is a measure of how much "stuff" there is in a given space. Higher density slows light. The light is bending twice on its journey through the water, glass, and air.

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Have a student insert a pencil (or pen, or their finger) into water and observe the distortion. The effect increases as the object moves more to the side. Have students move the pencil from side to side and front to back to see where the greatest and least distortion is.

The reason the pencil becomes so distorted is because the light refracts twice- it first changes speed as it moves between the water and glass, then again between glass and air.


Approximate speed of light through:

Water- 140,000 mi/sec

Glass- 124,000 mi/sec

Air- 186,000 mi/sec

4.



Do: Decoded a top-secret message with a red spyglass.

See: The red letters disappeared, and the green letters turned black.

What's Happening: The red letters blended in with the red water. The green was also absorbed into the red water, leaving behind a black silhouette.

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Tell student #4 to lay the red and green colored “PHYSICS!” sign on the table and then look at the letters again through the red “spyglass” (small flask with colored water). They will see the word “HI!”.

To add a little drama at the beginning, mention there’s a top secret message from your Principal hidden in the word.

The darker red the water is, the better. About half a dropper-full of red into about 20mL of water works well. Keep a close eye on students so they don’t spill the water- it will stain anything it touches. Keep flasks in the student materials box or in the middle of the table until it’s needed.

If you cannot print in color, print the black and white version and have the first group of students color the letters for you. The *H* and *I* and *!* are green, all others are red.

With any left over class time, or for an additional activity, give students red and green colored pencils and the red “spyglass” and allow them to come up with their own secret messages and trade them around. You’ll be amazed at how clever kids can be with this word game. Stay close and involved so messages stay clean.

Ask students not to drag the “spyglass” over the letters or it will smear red, but rather hold just over it, so it doesn’t smear red all over.

If you don’t have any Erlenmeyer flasks, regular beakers or even clear plastic cups with red water will also do the job.

Clean Up

Person 1

- Make sure all water is in the beakers

Person 2

- Take pennies out of cups

Person 3

- Count 4 new note sheets

Person 4

- Do you materials look like they did at the beginning of class?

Use this slide to direct students how to clean up and reset everything for the next class.

You'll need at least 5 minutes to reset everything for the next class.

Leave a stack of note sheets in your room.

If you don't want this slide to show, right-click on the slide and select "Hide Slide".

To help you with clean up, have your last science class take everything out of the boxes and put them in like piles in the back of your room.

Come back and visit InteractiveScienceTeacher.com to upgrade this lesson with:

PowerPoint- lead your students through the lesson click-by-click

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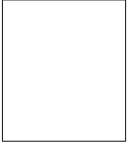
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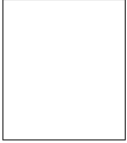
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Student Handout

Name _____ Date ____/____/____



Do: _____
See: _____
What's happening: _____



Do: _____
See: _____
What's happening: _____

Sign For Demo 4

PHYSICS!

PHYSICS!

PHYSICS!

PHYSICS!