

Science Distance Learning: Refraction of Light from an Arrow Through Water

Supplies Needed

Piece of Paper,

Marker

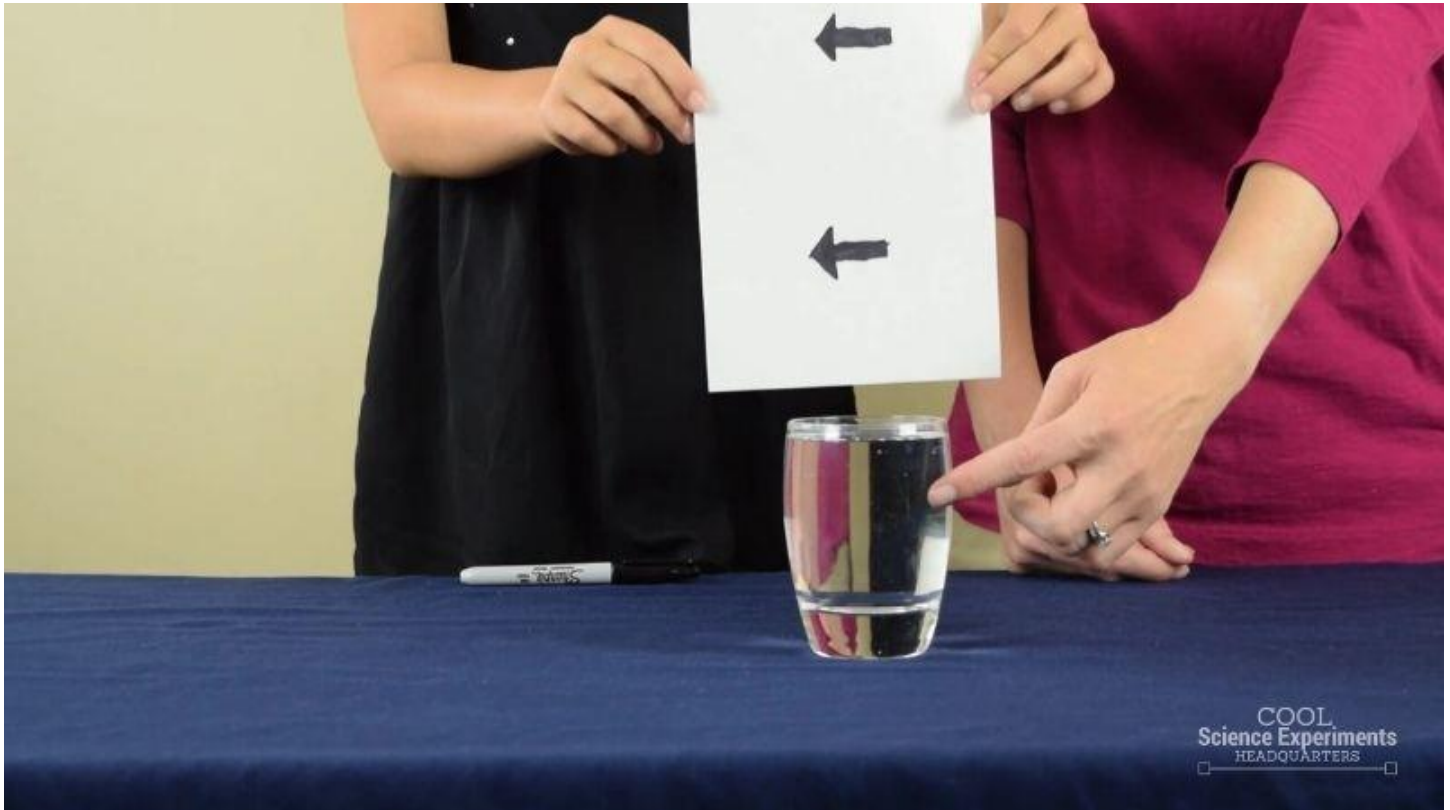
Glass

Water

Step 1 – Get a sheet of paper and draw two arrows on it using a marker. Draw one arrow near the top of the paper and one arrow near the bottom. Make the arrows point in the same direction. You can use a straightedge to make the arrows if you want

Step 2 – Fill a clear glass with water.

Step 3 – Slowly lower the piece of paper behind the glass of water.



Observation: What do you see happening? _____

The scientific concept that is at work in this experiment is called **refraction**. Refraction is the bending of light. Refraction occurs when light travels from one **medium** to another. (ie. air to water, water to air). Mediums, defined in the physical sciences, are **substances**, such as air, water, or glass that make possible the **transfer of energy**, such as light or heat, from one location to another.

During the experiment, the light traveled from the **image of the arrow** through the **air**, then through the **glass cup** into the **water**, and finally out of the glass cup and into the **air** once more before it reached our **eyes**. Light refracts as it passes from one medium to the next because **light travels at different speeds through those mediums**. Light travels **fastest** through **air**, a little **slower** through water, and even **slower** through **glass**.

This means that the light **bends once** when it **travels through the glass cup into the water**, and then it **bends again when it travels out of the glass cup and into the air**. As a result, **the light paths cross and the image appears to be flipped horizontally (left/right)**.

Directions: Read the above information and answer the questions below. Questions are in order of when they are discussed in the paragraphs below:

What is the scientific concept that is at work in the experiment? _____

What is refraction? _____

How are mediums defined in the physical sciences? _____

What medium is the glass cup made out of? _____

What medium filled the cup? _____

What medium is between the image of the arrow and the cup of water? _____

What medium is in the cup of water? _____

What medium is between the cup of water and your eyes?

What does light do when it passes from one medium to another? _____

Why does light refract (bend) as it passes through one medium to the next? _____

During the experiment, what medium did light from the image travel through just before . . .

. . .it reached the glass of water? _____

. . . it reached the water inside the glass? _____

. . . the light traveled out of the glass of water? _____

. . . the light reached our eyes? _____

Which medium used in the experiment does light travel fastest? _____

Which medium used in the experiment does light travel slowest? _____

Which medium used in the experiment does light travel slower than in air but faster than in water? _____

How many times does light bend as it travels through the mediums in the experiment? _____

When does the light first bend in the experiment? _____

When does the light bend again for a second time in the experiment? _____

What happens to the paths of the light rays as a result of being bent twice? _____

How does the image of the arrow appear because of this bending or refraction of light? _____

The diagram below shows what our eye sees as light from the image of the arrow travels through the air to reach our eyes.

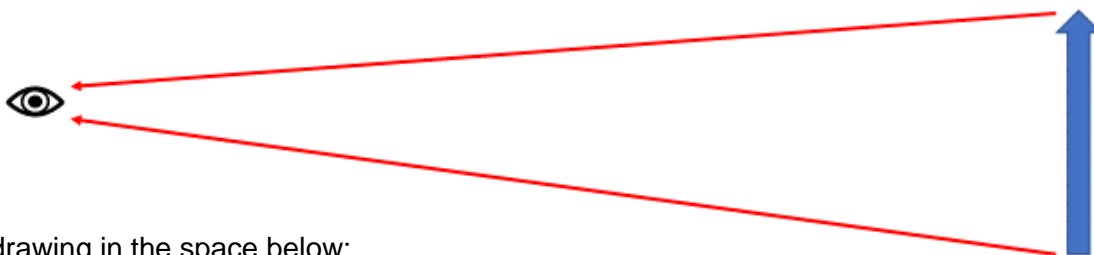
In the diagram below:

What media is represented by the white area? _____

What are the red arrows pointing to? _____

What do the red arrows represent? _____

Draw (in the space below) what the person viewing the arrow would see:



Make your drawing in the space below:

The diagram below represents what a person would see looking at the image of an arrow drawn on a paper held behind a glass of water.

In the diagram below:

What is represented by the white shaded area? _____

What is represented by the blue shaded area? _____

What happens when the light rays reflecting off the arrow . . .

. . . travel through the air and enter the glass of water? _____

. . . travel out of the glass of water and go in the air again? _____

. . . reach the focal point? _____

. . . reach our eyes? _____

