Phet Simulator: Bending Light!

Name: _____

Date: _____ Period: _____

1) Go to the following: https://phet.colorado.edu/en/simulation/bending-light and click **Play**, then click **Intro**.

2) When the simulator window opens, you should notice a laser pointing at a **45º angle downwards to the right**. Look to the right of the window and notice that the two information boxes are explaining the mediums that are shown on the screen. What are the **two mediums** on the simulator window currently?

_____

3) Click on the **RED** button on the laser. What **TWO** things does the light do as it hits the surface of the water?

_____

4) On the bottom left side of the simulator window, you should notice that you have two tools available for you to use. Select the bottom tool that looks a bit like a **magnifying glass**. Move the tool into the **general water area**.

5) Take the **LENS** and drag it directly over the light coming from the laser **BEFORE** it hits the surface of the water. Notice you can measure the intensity of the light when the lens is placed over the beam. Fill in the table below:

Laser pointed @ 10º angle from vertical	
Location of Lens	**Intensity of Light**
Beam of light BEFORE it hits the surface of the water	
Beam of light in the water	
Beam of light being reflected off of the surface	

Laser pointed @ 45º angle from vertical	
Location of Lens	**Intensity of Light**
Beam of light BEFORE it hits the surface of the water	

Beam of light in the water	
Beam of light being reflected off of the surface	

Move the lens out of the way and select the protractor tool from the toolbox. Place the protractor over the vertical dotted line **so that the dotted line runs straight through zero**. Confirm that the laser is coming in at a **45º angle.**

6) Now, move the laser pointer so that you ***change*** the angle of incoming light. Adjust the laser point so that it is only **10º to the left of the zero mark or vertical dotted line**. Once the laser pointer is in this location, move the protractor tool back to the tool box and fill in the table again below using the lens.

Laser pointed @ 80º angle from vertical	
Location of Lens	**Intensity of Light**
Beam of light BEFORE it hits the surface of the water	
Beam of light in the water	
Beam of light being reflected off of the surface	

Now, move the laser pointer so that you ***change*** the angle of incoming light again. Adjust the laser point so that it is **80º to the left of the zero mark or vertical dotted line**. Once the laser pointer is in this location, move the protractor tool back to the tool box and fill in the table again below using the lens.

7) a) Based on what you have observed, describe the ***relationship*** between the angle of incoming light and the percentage of light that is transmitted through the water versus the percentage of light that is reflected.

_____

_____

b) Describe how the **angle of incoming light compares to the angle of light reflecting off of the surface** of the water

(use the protractor tool if you are not sure):

_____

8) Bring the laser so it is shining directly down onto the surface of the water. Use the lens to measure the following:

a) What percentage of light **enters the water**? _____

b) What percentage of light is **reflected back upward**? _____

9) Click the **reset** button on the bottom right corner. You can CHANGE the mediums/materials on the right. For each of the following, **show (sketch) how light bends and reflects using the different medium boundaries**.

Option 1: Air and Water	**Option 2: Air and Glass**
Air	**Air**
Water	**Glass**

12) Explain what will happen if you pick the ***same medium*** for both the top and the bottom portions of the simulator window and turn the laser on.

Option 3: Water and Glass	**Option 4: Custom- you pick!**
Water	**Medium: _____**
Glass	**Medium: _____**

_____

_____

13) Adjust the mediums so that a ***denser medium*** is placed ABOVE a ***less dense medium***. Use the protractor to bring the laser light to a **60º angle** from the left of the zero mark (or dotted vertical line).

a) Sketch and label your choices below and show how the light behaves when coming in at a **60º angle**:

Medium: _____
Medium: _____

b) Explain what happens to the light when the laser is moved **downward between the 60º angle and the surface of the less dense medium below**:

_____

_____

_____

_____

c) What is this called? _____

14) Use the protractor to determine **at which angle** can you move the laser upwards so that you can begin to see the light enter the less dense medium below? _____

15) What is the only medium (not provided) that light would travel through even ***faster*** than air?

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