Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Creativity in Physics PHYS13796GD – Simulation #4: Optics and Light**

**Part A: Properties of Light**

* Open the Young’s Experiment Interactive ([https://www.physicsclassroom.com/Physics](https://www.physicsclassroom.com/Physics-Interactives/Light-and-Color/Youngs-Experiment/Youngs-Experiment-InteractiveV1)‐ Interactives/Light‐and‐Color/Youngs‐Experiment). Tapping the laser will change the colour of the laser beam, and tapping the panel with the slits will change the spacing between the slits. Click and drag the screen to move it closer and further away from the slits.
* Play around with the different combinations of laser colour, slit spacing, and screen distance and observe the changes in the pattern produced.

1. What two properties of waves are being observed?

* Next, open the Refraction Interactive (([https://www.physicsclassroom.com/Physics](https://www.physicsclassroom.com/Physics-Interactives/Refraction-and-Lenses/Refraction/Refraction-Interactive)‐ Interactives/Refraction‐and‐Lenses/Refraction/Refraction‐Interactive). This simulates a ray of light striking the interface between two different mediums.
* When the simulation first loads, the default mediums will be air on top and water below.
* Click ‘go’ to project the light ray. When the ray strikes the surface of the water, the ray will split in two, moving upward to the left and another moving into the water medium below.
* Click on the ‘show protractor’ and then position the protractor so that the centre point is at the point where the light ray strikes the water. The vertical dotted line corresponding to zero on the protractor is called the normal.

1. What angle, with respect to the normal, is the ray from the source striking the water at? What is the name of this ray and the name of this angle?
2. For the light ray travelling up and to the right, what is its angle with respect to the normal? What is the name of this ray and the name of this angle?
3. For the light ray travelling down and to the right, what is its angle with respect to the normal? What is the name of this ray and the name of this angle?
4. What two laws are being demonstrated by these three light rays, and what do these two laws state?
5. Based on these observations, would you say light travels faster or slower in water?

**Part B: Prisms and Colour**

* Launch the RGB Interactive([https://www.physicsclassroom.com/Physics](https://www.physicsclassroom.com/Physics-Interactives/Light-and-Color/RGB-Color-Addition/RGB-Color-Addition-Interactive)‐Interactives/Light‐ and‐Color/RGB‐Color‐Addition/RGB‐Color‐Addition‐Interactive). Leave the intensity of the 3 colours at 100%. Drag the 3 primary colour circles together, so that you have overlap between red and green, green and blue, blue and red, and finally red, green and blue. You should see intermediate colours between each pair, and a region in the centre where all three overlap.

1. Use this to complete the table:

|  |  |
| --- | --- |
| **Filter combination** | **Resultant color** |
| Red and blue |  |
| Blue and green |  |
| Green and red |  |
| Red and green and blue |  |

* Open the Filtering Away Interactive([https://www.physicsclassroom.com/Physics](https://www.physicsclassroom.com/Physics-Interactives/Light-and-Color/Filtering-Away/Interactive)‐ Interactives/Light‐and‐Color/Filtering‐Away). This will simulate looking at coloured objects through a coloured filter. Each coloured filter only allows a certain wavelength of light through. When you shine white light on a red filter, only red light passes through – all other wavelengths are filtered out.

1. Observe the 6 coloured circles as you change from one filter to the next. What do you notice? Why do some circles appear as a colour, and others appear black? Use what you learned from the RGB Colour Addition simulation to explain your results.

**Part C: Optics – Lens**

* Open the Refraction and Lenses Interactive ([https://www.physicsclassroom.com/Physics](https://www.physicsclassroom.com/Physics-Interactives/Refraction-and-Lenses/Optics-Bench/Optics-Bench-Refraction-Interactive)‐ Interactives/Refraction‐and‐Lenses/Optics‐Bench/Optics‐Bench‐Refraction‐Interactive).
* Select the **converging lens** and ensure the candle object is selected (usually the default object once the interactive is opened). Use your mouse to position the candle on the 2f location (2 times the focal length of the lens).

1. Where does the image appear?
2. Describe the image of the candle (i.e., larger or smaller than object, upright or inverted).
3. What type of image is this (real or virtual)?
4. How would you describe the path of the three light rays as they pass through the lens and move to the right?
5. Now move the candle until it is halfway between the focal length (f) and the lens. What happens to the image when you do this?

* Now select the **diverging lens** and re-position the candle object at the 2f location.

1. Where does the image appear?
2. Describe the image of the candle (i.e., larger or smaller than object, upright or inverted).
3. What type of image is this (real or virtual)?
4. How would you describe the path of the three light rays as they pass through the lens and move to the right?
5. Now move the candle until it is halfway between the focal length (f) and the lens. What happens to the image when you do this.
6. The lens of the human eye is which type of lens?
7. What type of corrective lens would be used by someone who suffers from myopia?