Science 8

Optics 6

Name:
Date:
Block:

1. **Lab activity**
2. **Concave/Convex Lenses**
3. **Law of Refraction**

Lab Activity

For the following, draw the rays that emerge from the ray box and through the convex and concave lens. Make sure to use a **ruler** for all straight lines.

Concave Lens

Ray Box	Concave Lens

Are the rays converging (coming together) or diverging (going apart)? _____

Where is the focal point? _____

Now take a **circular concave lens** and answer the following questions.

- Hold the lens a few inches from your eye to look at an object. Make sure the image is focused.
- Does the object look smaller or larger? _____
- Does the object look upright or inverted (upside down)? _____

Now compare a concave MIRROR and LENS

	MIRROR	**LENS**
Do the rays converge or diverge?		
If the object is far from the concave mirror/lens, it will appear…		
If the object is close from the concave mirror/lens, it will appear…		

Convex Lens

Ray Box	Convex Lens

Are the rays converging (coming together) or diverging (going apart)? _____

Where is the focal point? _____

Can you measure the focal length? (yes or no) If so, what is the focal length in cm? _____

Now take a **circular convex lens** and answer the following questions.

- Look through the lens at an object on the other side of the classroom.
  - Does the object look smaller or larger? _____
  - Does the object look upright or inverted (upside down)? _____
- Now look through the lens at the text on this paper. Make sure the text is in focus.
  - Does the text look smaller or larger? _____
  - Does the text look upright or inverted (upside down)? _____

Now compare a concave MIRROR and LENS

	MIRROR	**LENS**
Do the rays converge or diverge?		
If the object is far from the concave mirror/lens, it will appear…		
If the object is close from the concave mirror/lens, it will appear…		

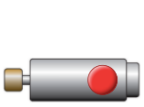
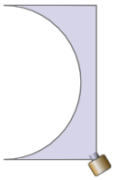
Concave/Convex Lenses

Concave Lens	**Convex Lens**
• A lens that is _____ _____. • _____ in the middle. 	• A lens that is _____ _____. • _____ in the middle. 
Uses of Concave Lens: • • •	**Uses of Convex Lens:** • • •

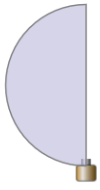
Activity: https://phet.colorado.edu/en/simulation/bending-light

1. Click "Prisms" 

2. Select the "multi-beam" light source. 
3. Place a **concave lens** in front of the light source. Turn the light source on.
4. Sketch what you see (with a ruler!!) in the box below:

5. **Are light rays converging or diverging?**
6. Take a concave lens. Look at this text. The image is _____ (upright/upside down) and _____ (smaller/larger).
7. With the same concave lens, look at something across the room. The image is _____ (upright/upside down) and _____ (smaller/larger).
8. Place a **convex lens** in front of the light source. Turn the light source on.
9. Sketch what you see (with a ruler!!) in the box below:

10. **Are light rays converging or diverging?**
11. Take a convex lens. Look at this text. The image is _____ (upright/upside down) and _____ (smaller/larger).
12. With the same convex lens, look at something across the room. The image is _____ (upright/upside down) and _____ (smaller/larger).

Law of Refraction

- The _____ or _____ _____ of light rays as it moves from one material to another.
- Light rays move at _____ _____ depending on the _____ of the materials it is travelling through.

Materials:

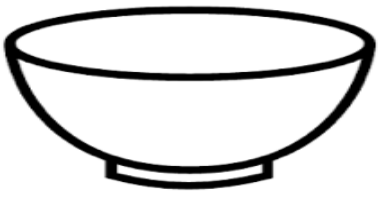
- A small opaque bowl
- A pen
- Water

Procedure:

1. Place the bowl on the lab bench.
2. Have one partner slowly walk away from the bowl so that the X is just out of sight.
3. Without moving your position, have the other partner slowly pour water into the bowl.
4. Switch roles and repeat the experiment.
5. Clean up your materials.

Question:

1. What do you notice when the water is poured into the bowl? _____
2. What happens when light passes from one material to another? _____
3. Draw what you think the path of light is in this experiment:

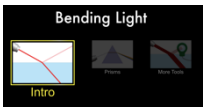


Density

- How tightly the molecules are packed together.

- The _____ the density, the more _____ it is for the light rays to pass through.
- The more difficult, the _____ the light rays will travel and will therefore bend _____ the normal.

Activity: https://phet.colorado.edu/en/simulation/bending-light

1. Click "Intro". 

2. Confirm that the TOP material is "Air" and the BOTTOM material is "Water".
3. Turn on the light!
4. Bring the protractor over from the bottom left box and line the "0" up with the normal (dotted line). 
5. In the AIR, what is the **angle** between the normal and the incident ray? _____
6. In the WATER, what is the **angle** between the normal and the refracted ray? _____
7. Repeat steps 3-6 and fill in the following table:

Experiment	Top material	Bottom material	Incident Angle	Refracted Angle
1	Air	Water		
2	Water	Glass		
3	Air	Glass		
4	Water	Air		
5	Glass	Water		

8. In which experiments was the beam of light going from a material that is **less dense to more dense?**

9. In those experiments, is the refracted angle greater or less than the incident angle?

10. In which experiments was the beam of light going from a material that is **more dense to less dense?**

11. In those experiments, is the refracted angle greater or less than the incident angle?

Conclusion:

When moving from a material that is _____ dense to a material that is _____ dense, the light rays will:

1.

2.

Diagram:

air

glass

When moving from a material that is _____ dense to a material that is _____ dense, the light rays will:

1.

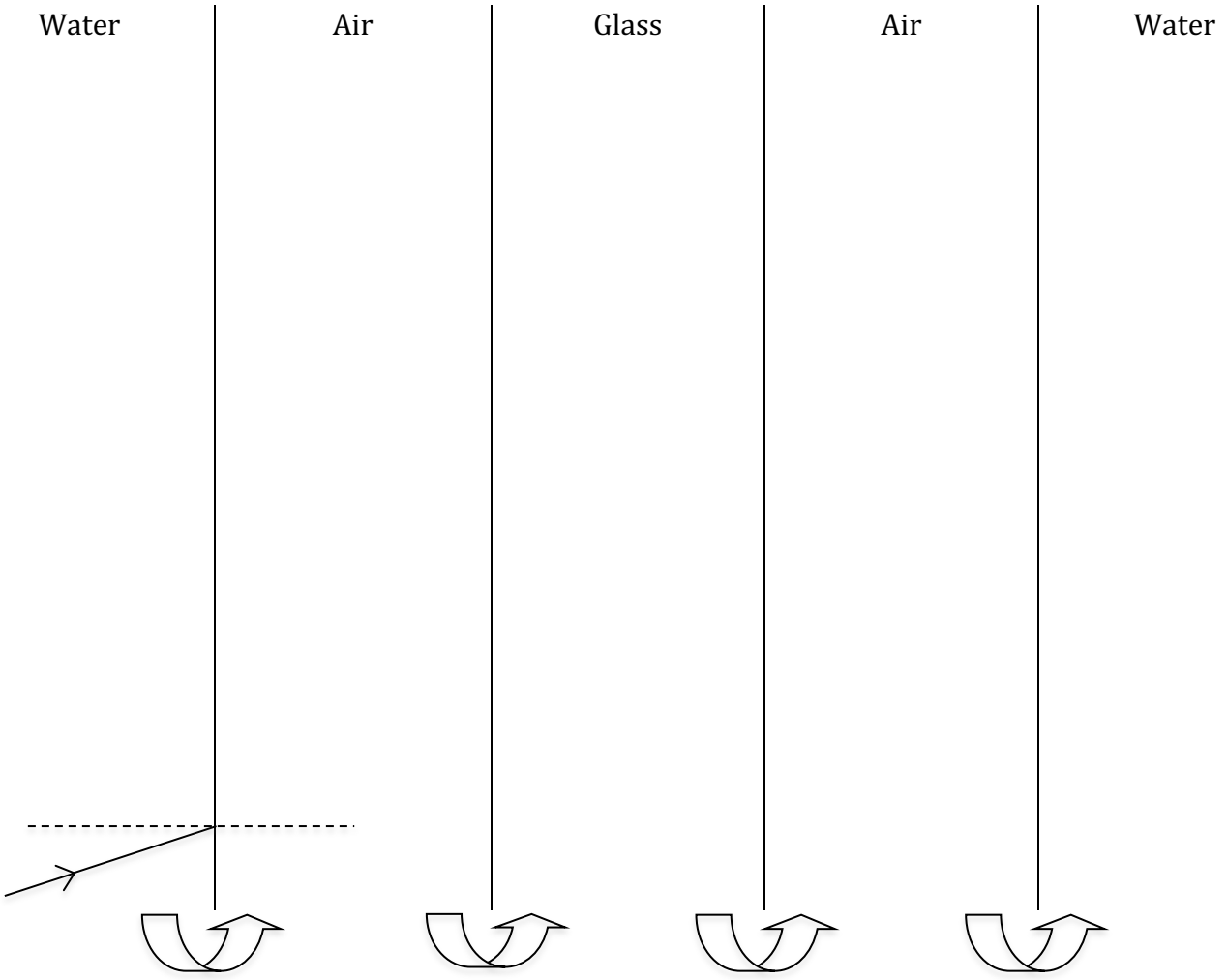
2.

Diagram:

glass

air

Draw a sketch of how light behaves as it passes from left to right through the following materials. Remember there is a NORMAL at every boundary!



Material more or less dense?	Material more or less dense?	Material more or less dense?	Material more or less dense?
Light will bend toward or away from normal?	Light will bend toward or away from normal?	Light will bend toward or away from normal?	Light will bend toward or away from normal?