Student Handout 1.1: UV Resin Lens Challenge Lab

Name: _____ Date:_____Period:_____

Convex lenses play a crucial role in scientific research. By making and testing your own lenses, you will understand how lens shape, focal length, and magnification are interconnected, and how these properties enhance our ability to observe fine details in various fields such as biology, medicine, and materials science.

Goal: To create a high-performing lens that achieves the highest magnification and shortest focal length.

i. Protocol For Making Your Own UV Resin Lenses:
Follow steps 1- 9 below to make your own 12 mm, 9 mm, 6 mm, and 3 mm diameter resin lenses.

1. Prepare the Base
    - Place the polypropylene base onto the lens bed.
2. Prepare the Lens Holder
    - Start with the 12 mm diameter lens holder.
    - Remove the protective tape from both sides.
    - Attach the 12 mm diameter sticker to one side of the lens holder.
3. Position the Lens Holder
    - Place the lens holder, sticker side down, on top of the polypropylene base in the lens bed, with the hole aligned at position #1.
4. Apply UV Resin
    - Carefully drip UV resin into the hole while holding down the lens holder to keep it flat.
    - Add resin until it forms a visible curved shape above the lens holder surface.
    - Do not overfill to prevent spillage.
5. Harden the Resin
    - Shine the UV flashlight on the resin for about 30 seconds or until it hardens.
6. Flip and Repeat
    - Flip the lens holder over so the sticker side is up and position it at position #2 on the lens bed.
    - Carefully apply resin using the sticker as a guide to create an equivalent curved shape.
7. Harden the Resin Again
    - Shine the UV flashlight on the resin for another 30 seconds or until it hardens.
8. Remove and Observe
    - Remove the lens holder from the lens bed.
    - You should now have a biconvex lens with a curved bulge on both sides.
9. Repeat for Other Sizes
    - Repeat steps 2–8 using the 9 mm, 6 mm, and 3 mm diameter lens holders.

- By the end, you should have a set of four lenses in different sizes.

ii. Protocol For Testing Your Resin Lenses:
Follow steps 1-7 for each lens. Be sure to record all your measurements in the corresponding data tables below.

1. Attach the Lens:
    - Securely attach your resin lens to your phone camera.
2. Focus and Capture Image:
    - Open your phone camera and focus on the metric side of a ruler using the lens attachment.
    - Take a photo of the focused lines on the ruler.
3. Measure Object Distance:
    - Measure the object distance (d_o) from the lens to the ruler.
    - Record object distance (d_o) in the corresponding table below.
4. Measure Heights:
    - Measure the height of the image (h_i) of the ruler lines in the photo.
    - Record the actual height (h_o) of those same lines directly on the physical ruler.
    - Repeat steps 3-4 for each lens.
5. Calculate Magnification:
    - Use the magnification equation to calculate the magnification (M) for each lens.
6. Calculate Image Distance:
    - Calculate the image distance (d_oi) for each lens using the magnification.
7. Calculate Focal Length:
    - Finally, calculate the focal length (f) for each lens using the lens equation.

Data Tables:
Record all of your measurements in the corresponding tables below. Please use the following equations to fill in the missing information in the tables.

Lens Equation:

$$1/f = 1/d_o + 1/d_i$$

Magnification Equation:

$$M = h_i/h_o = -d_i/d_o$$

12 mm Lens

Object distance (d_o)	
Object height (*h*o)	
Image height (h_i)	
Magnification *(M)*	
Image distance (d_i)	
Focal length *(f)*	

9 mm Lens

Object distance (d_o)	
Object height (*h*o)	
Image height (h_i)	
Magnification *(M)*	
Image distance (d_i)	
Focal length *(f)*	

6 mm Lens

Object distance *(d_o)*	
Object height (*h*o)	
Image height (h_i)	
Magnification *(M)*	
Image distance *(d_i)*	
Focal length *(f)*	

3 mm Lens

Object distance *(d_o)*	
Object height (*h*o)	
Image height (h_i)	
Magnification *(M)*	
Image distance *(d_i)*	
Focal length *(f)*	