Water Glass Optics

Introduction

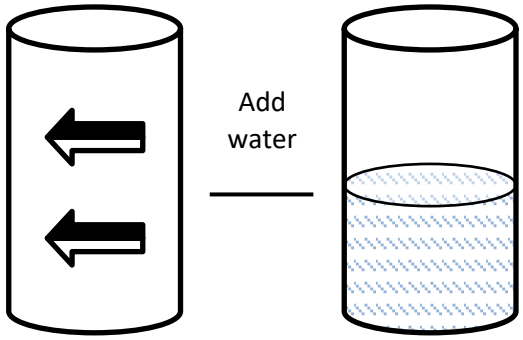
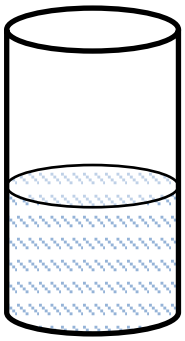
Using an ordinary water glass and some water, you can discover some basic principles of optics. The objects you will be observing will be a card with two arrows. Your goal will be to predict and then observe how like the size of and orientation of the object changes with its position, relative to the water class.

Materials

Round water glass
12 inch ruler or measuring tape
Binder clip or tape (to hold arrow card in place)
Arrow card (attached)

Step 1: Observe the arrows

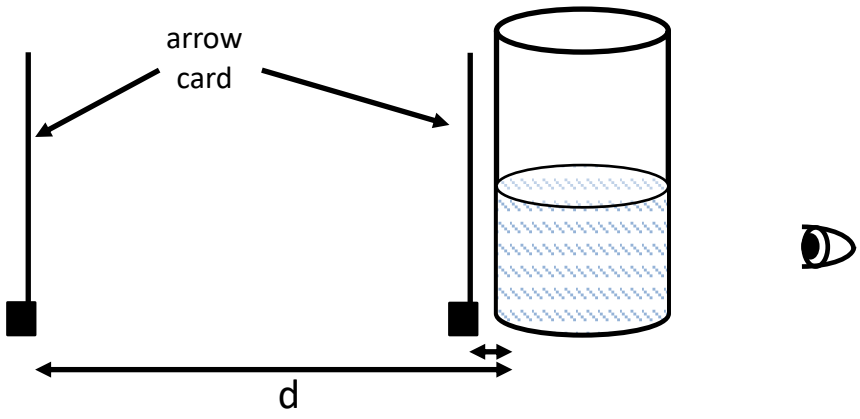
Use a binder clip (or tape, clay, Play Doh, etc.) to support a card with two arrows directly behind an empty water glass as illustrated in the cartoon below.

<table>
<tr><th colspan="2">Predictions – What do you think?</th></tr>
<tr><td>Draw how you predict the arrows will appear when water is poured into the glass to a level halfway between the arrows.</td><td> 
</td></tr>
<tr><th colspan="2">Observations</th></tr>
<tr><td>Explain what you actually observed, below.</td><td>Draw the appearance of the two arrows behind the glass with the glass half-filled with water on the picture below.
  </td></tr>
</table>

	Explanation
Why do you think this happens?	

Step 2: Change the distance of the arrow card

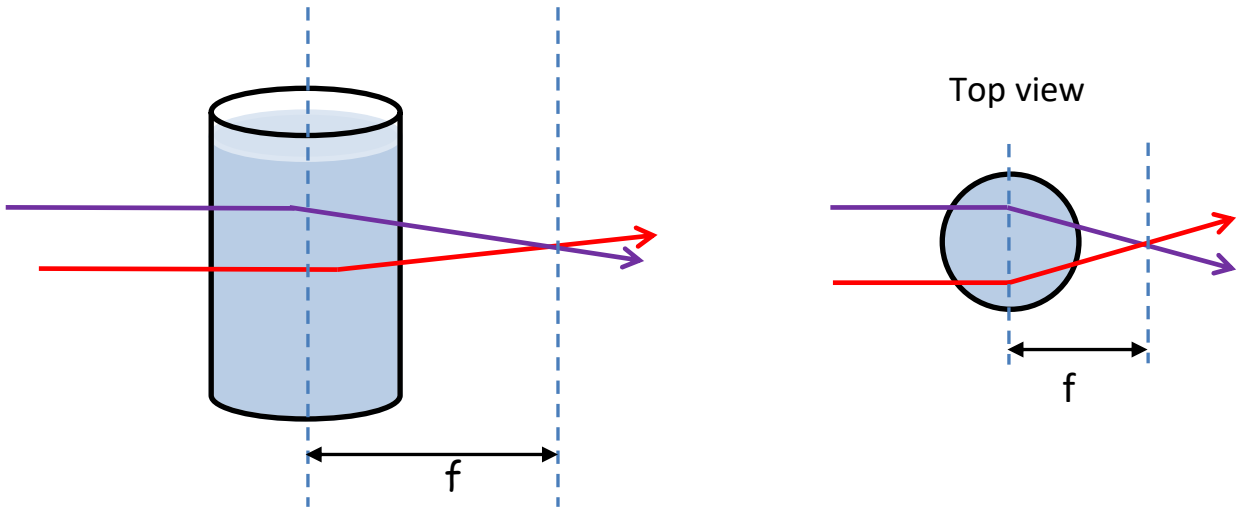
Closer and further – What do you predict?	
Describe what you think you will see if you move the arrow card further and further from the half-filled glass.	



Observations – Do it and check your prediction	
d	Draw the appearance of the lower arrow from your point of view.
Smallest (the glass touches the screen)	
5 cm	

10 cm	
15 cm	

Step 3: Measure the focal length



Observations – What is the measured focal length?

Step 4: Analyze the effect of d/f

Observations – Draw the appearance of the bottom arrow:		
When $d < f$	When $d \approx f$	When $d > f$
Describe	Describe	Describe

Arrow card: