# REFLECTION OF WAVES
# (or *RIPPLE WHILE YOU WORK*)

In this lab you are going to explore the behavior of incident and reflected water waves on both flat and curved surfaces in order to confirm the ***law of reflection***. (Key words will be ***italicized***.)

**NOTES:** *Electricity and water don't mix!!! Please <u>be careful</u>!
*Be sure water in ripple tank is same depth (about 1 cm) throughout; adjust table legs if necessary.
*Do all 7 sketches back-to-back on long plain paper. Label each sketch with its number and place them in the correct order when submitting. Write an explanation on each sketch.
*Don't bump table once you are set to start! This will produce undesirable rectangular waves.
*Use straightedge for accuracy and neatness.

## INTRODUCTION

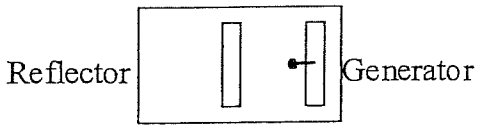
1. Dip your finger once in the water to generate a single ***wavefront*** (notice its shape). Observe the shadow of the wavefront on the screen underneath the tank. Do this several times to get a clear shadow image so you are sure of what you are supposed to be seeing. Adjust light as necessary.

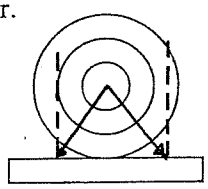
2. Now run the motor at a <u>slow</u> speed (***frequency***). Adjust the speed at which the incident and reflected waves move so that where the waves interfere they appear to be standing still (***standing waves***).

3. Carefully increase the speed (frequency) of the motor. Do <u>not</u> race the motor, it may fall into the water. Observe what changes occur in the wave pattern and to the ***wavelength***. Answer **question #1**.

## PART I: REFLECTION OF CIRCULAR WAVES

1. **Sketch #1:** Use the ***circular wave generator*** and straight reflector to sketch circular waves and their reflections. Trace the bead and reflector positions on the paper. Tap the generator in short bursts and sketch several ***incident and reflected wavefronts***. Some guidance: tap the generator with your finger; be sure that only the bead taps the water and doesn't hit the glass bottom; position the reflector so its shadow is in the middle of the paper and the bead's shadow is at the end of the paper.



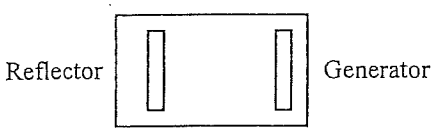



2. Label the sketch (#1), showing: generator, reflector, incident and reflected waves, ***direction of propagation*** arrows, angles of incidence and reflection, location of apparent (***virtual***) source of reflected waves (use parallax), and sketch explanation. Answer **question #2**.

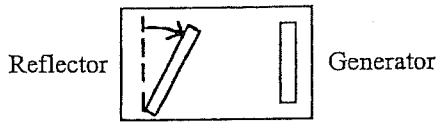
## PART II: REFLECTION OF STRAIGHT WAVES

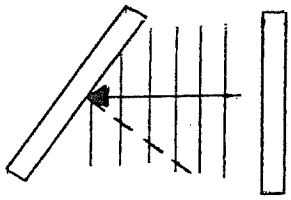
1. Reconfigure the generator to produce straight waves. Reposition the straight reflector so that its shadow is at the opposite end of the paper from, and parallel to, the generator.

2. **Sketch #2:** Using the other side of the paper from sketch #1, trace the generator and reflector positions. Produce straight waves by tapping the generator with your finger. Sketch several incident and reflected wavefronts close to the reflector. Label the sketch (#2), showing: generator, reflector, incident and reflected waves, direction of propagation arrows, and sketch explanation.



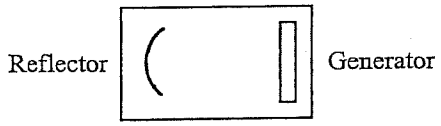
3. **Sketches #3-5:** On a clean side of paper (but back-to-back), repeat step 2 (sketch #2) for angles of 30, 45, and 60 degrees between generator and reflector. Label these sketches (**#3, 4, 5**), showing: generator, reflector, incident and reflected waves, direction of propagation arrows, angles of incidence/reflection, and sketch explanation. Remember, angles are measured relative to the ***normal*** to the reflector using the direction of propagation arrows. Answer **Question #3.**

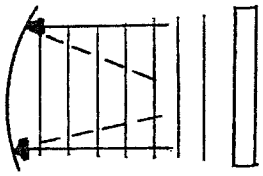


## PART III: CURVED MIRRORS

1. Replace the straight reflector with a curved reflector so that the ***concave*** side faces the generator. Tap the generator with your finger and observe the wavefront pattern produced.

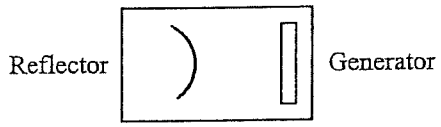


2. **Sketch #6:** On a clean side of paper, trace the generator and reflector positions. Tap the generator with your finger to produce straight waves. Sketch several incident and reflected wavefronts close to the reflector. Label the sketch (**#6**), showing: generator, reflector, incident and reflected waves, direction of propagation arrows, angles of incidence/reflection, ***focal point*** and distance (cm), and sketch explanation. Answer **Question #4.**

3. Tap the water at the focal point of the reflector and observe how these circular waves are reflected from the concave reflector. Answer **Question #5.**

4. **Sketch #7:** Turn the reflector around so that the ***convex*** side is facing the generator. On a clean side of paper, repeat step 2 (sketch #6). Be careful to leave enough room on the paper to label the virtual focal point and its distance. Label the sketch (#7), showing: generator, reflector, incident and reflected waves, direction of propagation arrows, angles of incidence/reflection, virtual focal point and distance (cm), and sketch explanation. Answer **Question #6.**




**LAB REPORT:** Complete group report including: cover page, purpose, procedure, 7 sketches with labels and explanations, questions, conclusion, and summary. Report worth 30 points.

**Questions:** Answer the following questions in complete sentences (on clean sheet of paper):

1. In the introduction, why do waves appear to stand still? What affect does increasing wave frequency have on wave pattern and wavelength?
2. In part I, does the law of reflection hold true for curved waves reflecting from straight reflectors? Explain your answer.
3. In part II, does the law of reflection hold true for straight waves? Explain your answer.
4. In part III, does the law of reflection hold true for straight waves reflecting from curved reflectors? Explain your answer.
5. In part III, what is the shape of waves reflecting from the concave reflector when you tap your finger at the focal point?
6. In part III, how does the location and distance of the convex reflector's focal point compare to that of the concave?