# *MND Physics*

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## Behavior of Waves
## Reflection, Refraction, Diffraction, Interference

In this lab, you will investigate the properties of water waves in a ripple tank. The following four specific wave properties will be investigated:

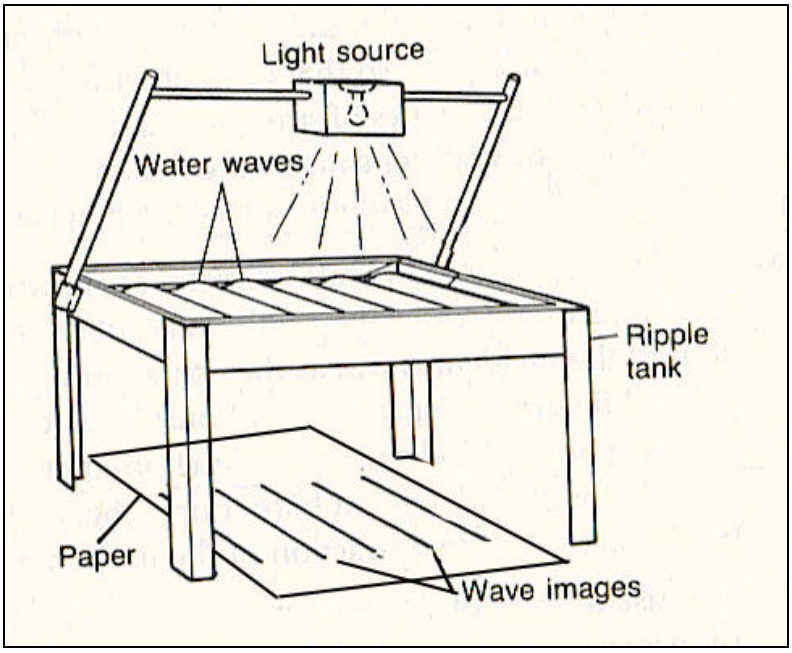
**Reflection:** The law of reflection states that the angle of incidence equals the angle of reflection.

**Refraction:** Waves undergo a speed change as they pass from one medium to another (in this case, from deep water to shallow water).

**Diffraction:** Waves spread out (bend) as they pass the edge of a barrier.

**Interference:** The result of the superposition of two or more waves causes the waves to increase in amplitude, decrease in amplitude, or be canceled out altogether. This is known as constructive and destructive interference.

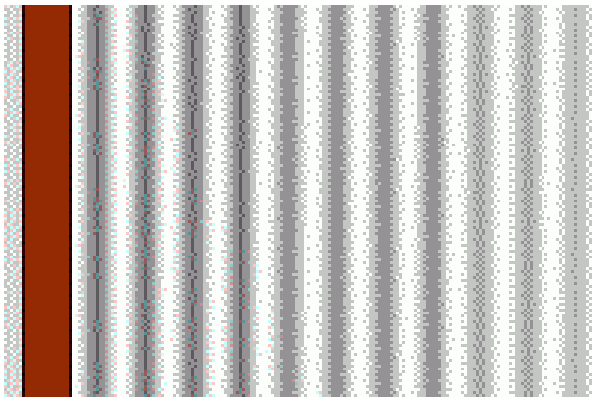
**EQUIPMENT:**
Ripple tank or water wave tank, light source, 500 ml beaker, cool tap-water, assorted barriers, wood dowels, automated wave generator, drawing paper, colored pencils, protractor, paper towels, meter stick, glass plates.




**PROCEDURE:**

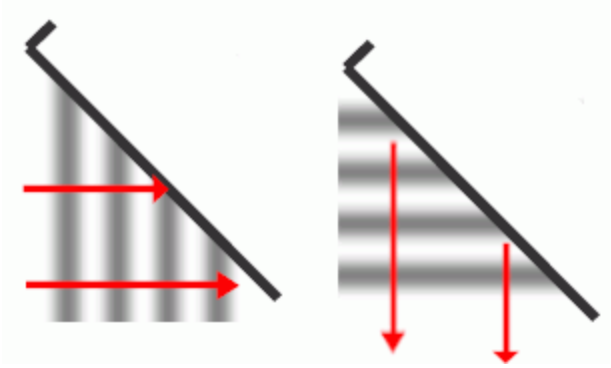
Set up the tank as shown. Gently add water so that the water level is exactly 3 cm above the glass. Place a sheet of drawing paper (provided) underneath the tank (orient the sheet so that the longer dimension is perpendicular to the length of the table. In this configuration, you don't need to lift the legs of the tank to change sheets).

Practice making waves: gently roll the large wood dowel back and forth to generate wave pulses as follows:



**Reflection:**

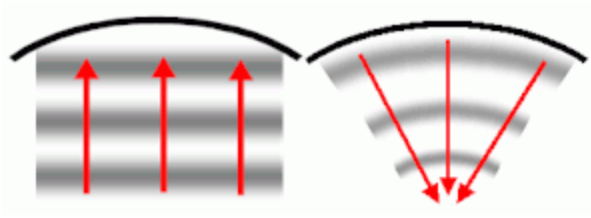
Gently roll a wood dowel back and forth to produce straight pulses at one end of the tank.
Place a straight barrier at the opposite end of the tank such that the angle of incidence = 0 degrees. Observe and record a description of what happens.
Next, move the barrier such that the angle of incidence is 45 degrees.



Again, gently roll a wood dowel back and forth to produce straight pulses moving towards the angled barrier. Observe and record a description of what happens. Measure the angle of reflection using a protractor.

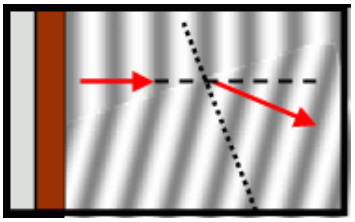
Next, move the barrier such that the angle of incidence is about 60 degrees. Again, gently roll a wood dowel back and forth to produce straight pulses moving towards the angled barrier.
Observe and record a description of what happens. Measure the angle of reflection using a protractor.

Remove the straight barrier and replace it with a curved one. Gently roll a wood dowel back and forth to produce straight pulses moving towards the curved barrier. Observe and record a description of what happens.

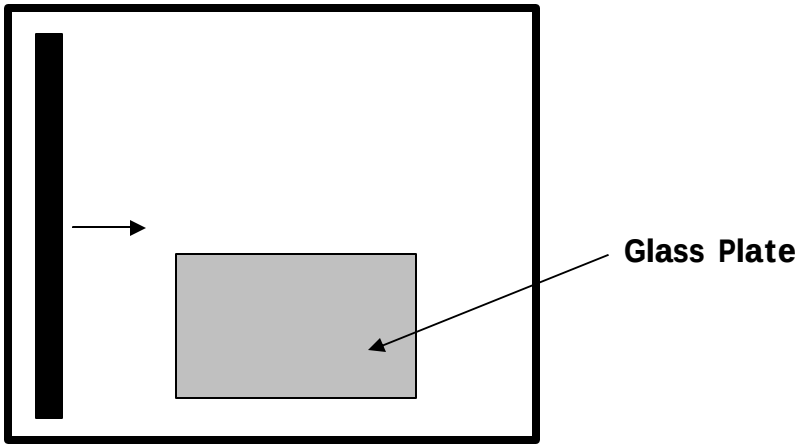


Based on your observations, make a general statement concerning reflection.

**Refraction:**

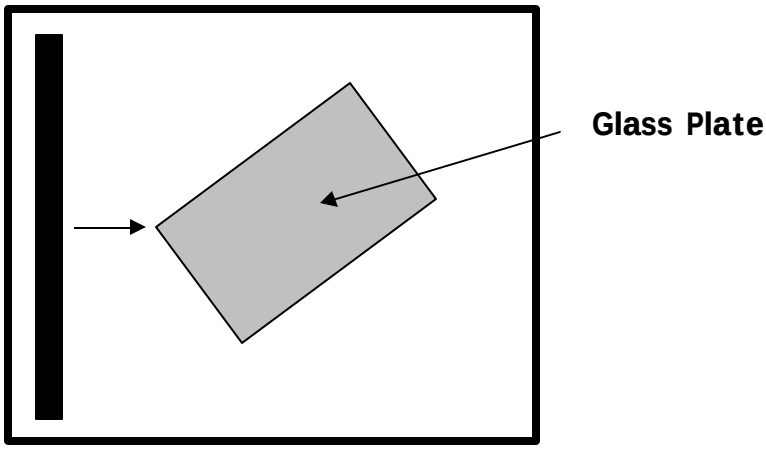


Place a glass plate in the center of the tank and off to one side. Make sure the water depth is very shallow over the plate.

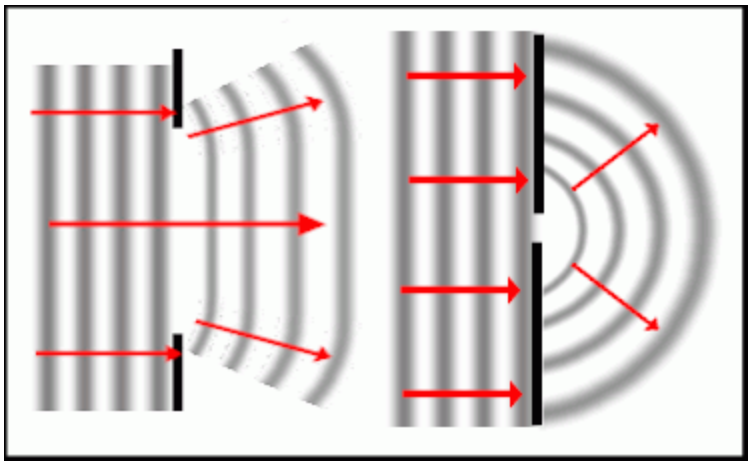



Send straight pulses toward the plate. Carefully observe the pulses at the shallow-water boundary. Sketch the patterns you observe as the waves move through the shallow medium.

Next, rotate the plate so that one corner is pointed towards the incident waves. Send a series of waves toward the plate. Sketch the patterns you observe. Remove the plate.



**Diffraction:**



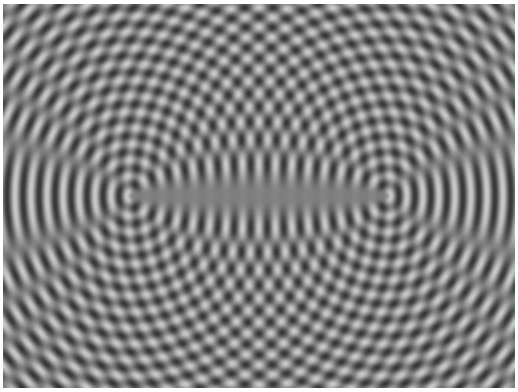
Arrange two barriers as shown. The opening should be approximately 10 cm wide. Generate a series of wave pulses and observe the bending of the waves as they pass the edge of the barriers. Sketch the pattern you observe.

Next, make the barrier opening smaller and repeat the above process. Sketch the pattern you observe.

Finally, make the opening a small slit (smaller than 1 cm) and repeat the above process. Sketch the pattern you observe.

Using the powered wave generator, observe the effects of the rate at which waves are produced. Start with a slow speed, increasing to a fast speed. What effects does speed have on the amount of bending around a barrier?

**Interference:**



Place the two point source generator on the ledge at one end of the tank. Set the generator to a low speed setting and observe the wave pattern. Sketch your observations.

Now increase the speed of the wave generator. Sketch your observations.

Does speed (frequency) affect the wave pattern?

**QUESTIONS:**

REFLECTION:

1. How can you apply the law of reflection to racquetball and billiards?

REFRACTION:

1. What happens to the velocity of a water wave as it is refracted?
2. What happens to the frequency of a water wave as it is refracted?
3. What happens to the wavelength of a water wave as it is refracted?
4. How can ocean waves help locate underwater reefs and sandbars?

DIFFRACTION:

1. Does changing the frequency affect the degree of bending around a barrier?

INTERFERENCE:

1. Does wave frequency affect the pattern? If so, how?