Ripple Tank

Frequency, Velocity, and Wavelength

There is a distinct relationship between frequency, wave velocity, and wavelength. If you know any two, you can determine the third simply by using the formula \( v = f \lambda \).

Purpose:
To study the relationship between velocity, wavelength, and frequency.

Equipment:
- Ripple tank
- Plane wave actuator bar
- Wave Generator
- Electronic stroboscope

Cautions:
This equipment is delicate. Everything should go together with the lightest of touches. Do not force anything!

You may find that some of the setup procedure has already been done for you. Check each step to make sure that it is done properly. The success of your work depends upon correct setup!

Procedure to set up the ripple tank
1. Level the tank by screwing the feet in or out, using the circular level provided.
2. Fill the tank to a depth of about 0.5 cm.
3. Attach the plane wave actuator bar to the ripple generator.
4. Set the amplitude to 5 on BOTH sides of the wave generator.
5. STOP read entire step before continuing. Make sure that the wave generator phase control is set to zero. If it isn’t, loosen the lock on the opposite side of the wave generator, zero the control, and tighten the lock. Adjusting the phase w/o loosing the lock ruins the generator.
6. Position the wave generator so that the actuator bar is just touching the surface of the water.
7. Make sure that the strobe and light is positioned over the ripple tank.
8. Place a sheet of white paper on the table under the ripple tank.

Data Collection:
1. Turn the ripple generator frequency control to H.
2. Turn on the stroboscope and use it to freeze the projected image of the waves. *Using the two arrows on the strobe to adjust the frequency of the strobe until the waves appear to be stationary. Start with the stroboscope at its maximum value (24.9Hz). (Do not push the circle button)*
3. Record the frequency of the waves in the table below.
4. Measure and record the wavelength of the water waves on the table below. *Measure the distance from one bright bar to the next on the projected image. This distance is the wavelength. Do not forget to convert the measurement to meters!*

5. Repeat steps 1 through 4 for frequency settings G, F, E & D. *Record frequency and wavelength data for each setting*

6. Calculate the velocity of the waves using the data in the table. (Remember \( v = \Omega \lambda \))

<table>
<thead>
<tr>
<th>setting</th>
<th>frequency (Hz)</th>
<th>wavelength (m)</th>
<th>velocity (m/s)</th>
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<tbody>
<tr>
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<td>D</td>
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</tbody>
</table>

**Questions:**

1. What do you notice about the relationship between the frequency and the wavelength?

2. What do you notice about the velocity of the wave as the frequency changes?
3. The velocity should have been the same for all frequencies. Was it? If not, what are some sources of error that could have affected the results?

Extension question:

1. What do you think would happen to the wave speed if the depth of water is increased?