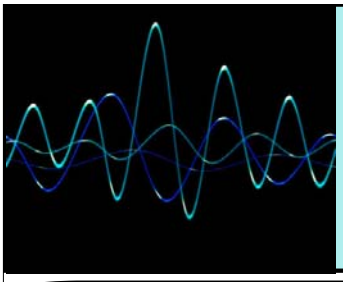


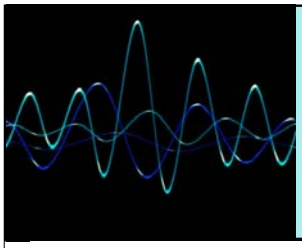
Unit 4: Oscillatory Motion and Mechanical Waves

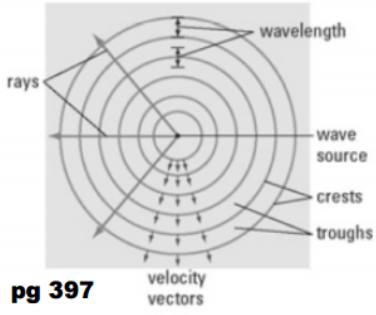
4.5 Reflection and Interference

When studying waves, they have the ability to:

- reflect (Physics 20)
- refract (Physics 30)
- superimpose (Physics 20)
- diffract (Physics 30)

So far we have seen waves shown as a sinusoidal curve. But ripples in a pond do not look like a sinusoidal curve. That's okay because we can still study these waves in a slightly different manner.





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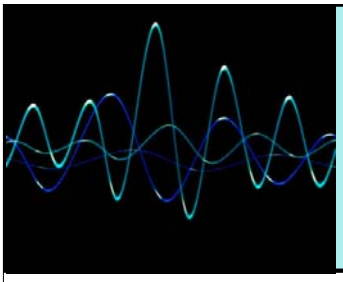
Notice this wave diagram also has:

- crests (circular lines)
- troughs (halfway between adjacent lines)
- wavelength (λ, the distance between crests/troughs)
- velocity (direction and speed of wave movement)

However, this diagram also introduces a new term: rays.

A ray is a line drawn perpendicular to wave fronts or crests. The ray indicates the direction of movement of the wave.

http://www.acoustics.salford.ac.uk/feschools/waves/super.php

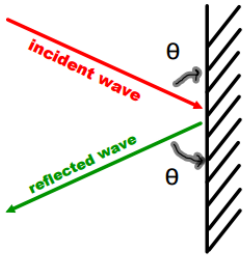



Reflection

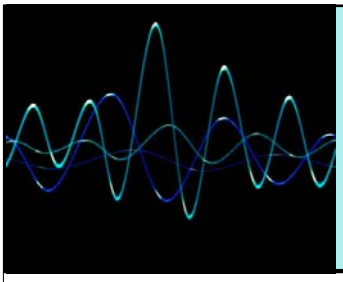
When a wave pulse hits a barrier of different density, it will reflect.

In a relfection, all properties of the wave (λ, v, T) stay the same; only the direction changes.

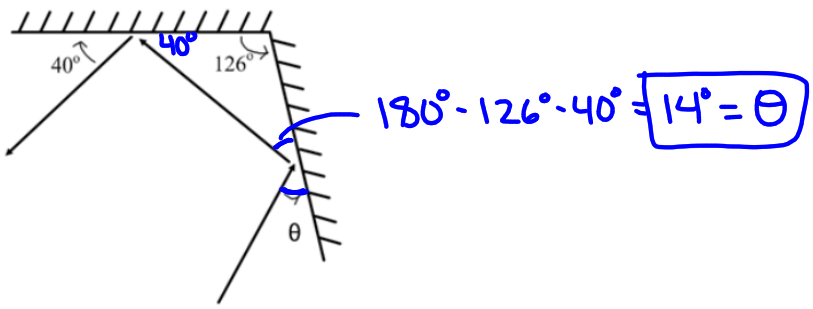
We call the wave an incident wave before it strikes the boundary and a reflected wave afterwards.



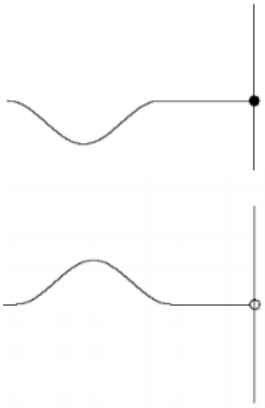
In a wave reflection,
Angle of Incidence = Angle of Reflection




Ex.) Determine the angle θ below:



Waves in a spring or string also reflect:



When a crest is incident (hits) a fixed boundary, it relfects and inverts to a trough.

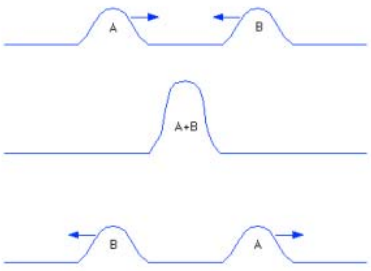
When a crest hits an unfixed boundary, it reflects as a crest.

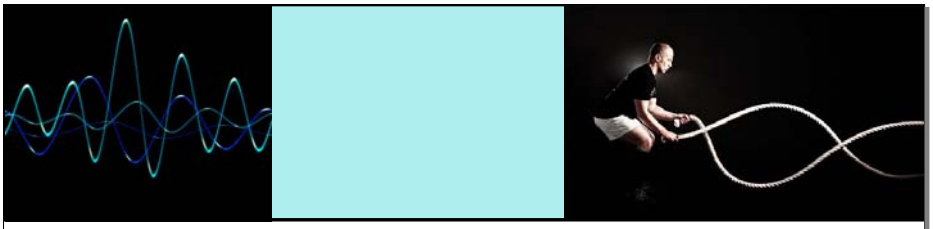
http://www.acs.psu.edu/drussell/Demos/reflect/reflect.html

So what happens if we send two crests at each other? Two troughs? A crest and a trough?

This is called;

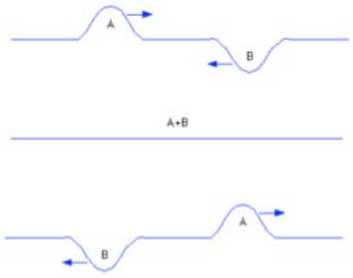
Constructive Interference - overlap of waves to create one wave with a larger amplitude.





SImilarily, when a crest and trough meet, their amplitudes are added. However, this results in a pulse of smaller amplitude (or no amplitude) being created. This is known as destructive interference.

Destructive Interference - overlap of pulses to create a pulse of smaller amplitude.



The idea behind constructive and destructive interference are referred to as **superposition**.

The effect can be found in wave front waves:

Where the waves overlap, we have constructive interference (the waves are in phase).

Where the waves are not overlapping, we have destructive interference (waves are out of phase).

Activity: Pg. 414-415 (Read the instructions first, do the activity, answer the analysis questions.)