Teachers' notes

Lesson notes

Adding Waves

1) Students will be able to use the principle of superposition to explain interference patterns.

2) Students will be able to use the universal wave equation.

Back

Teachers' notes

Lesson notes

Subject	Type text here
Topic	Type text here
Title	Type text here
Grade(s)	Type text here
Cross-curricular link(s)	Type text here
Prior knowledge	Type text here
Intended learning outcome(s)	Type text here

Teachers' notes

Lesson notes

Back

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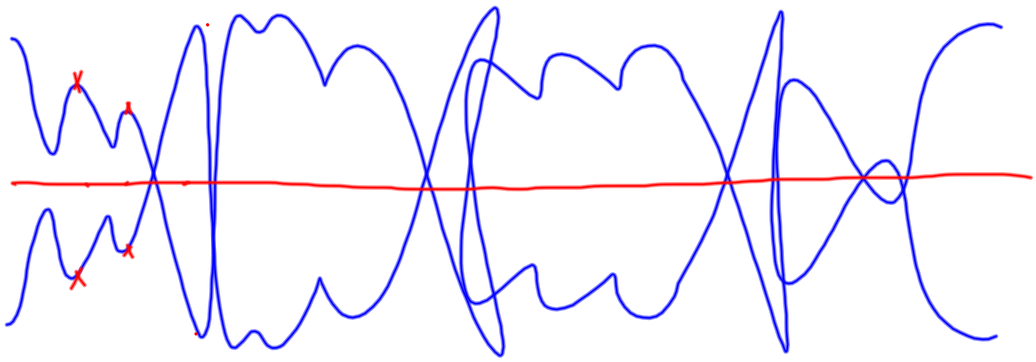
Activity: Two Point Wave Sources

1. Use two fingers as point sources at opposite ends o the ripple tank. Observe what happens when the wave fronts meet.

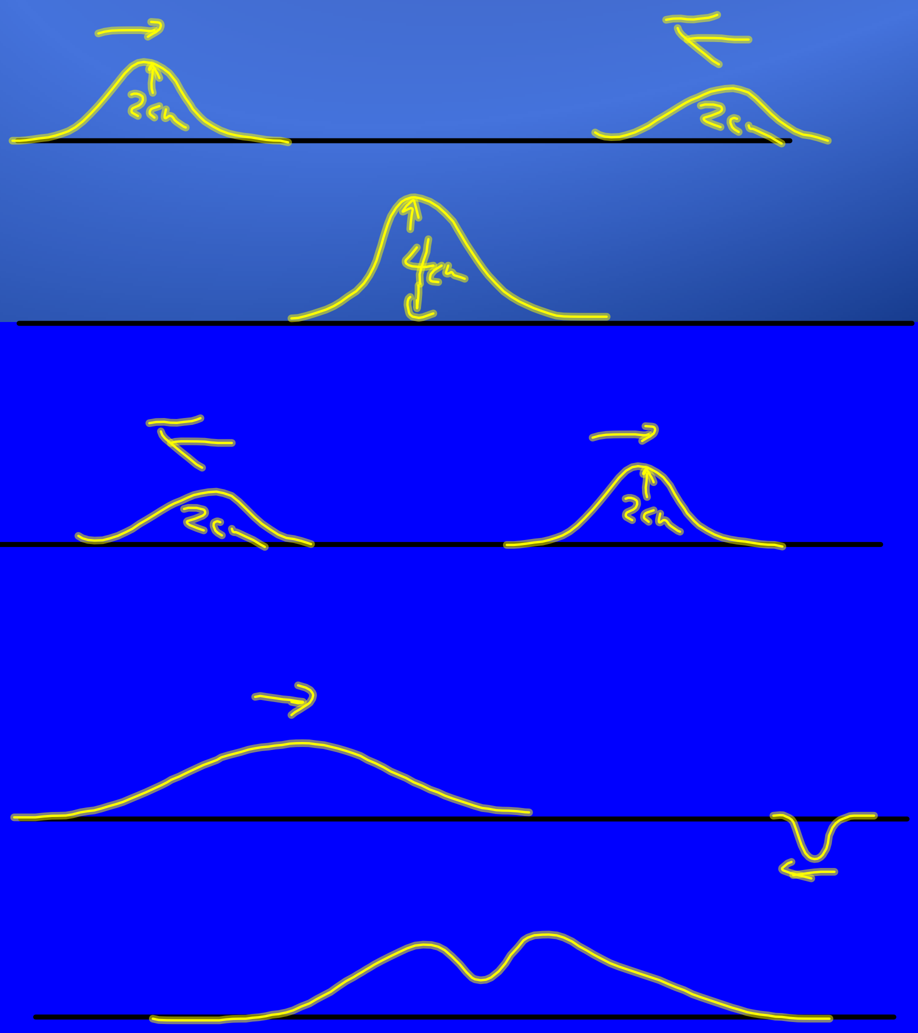
2. Turn on the 2-point wave generator. Observe how the waves emitted by each point source interact.



Superposition and Interference

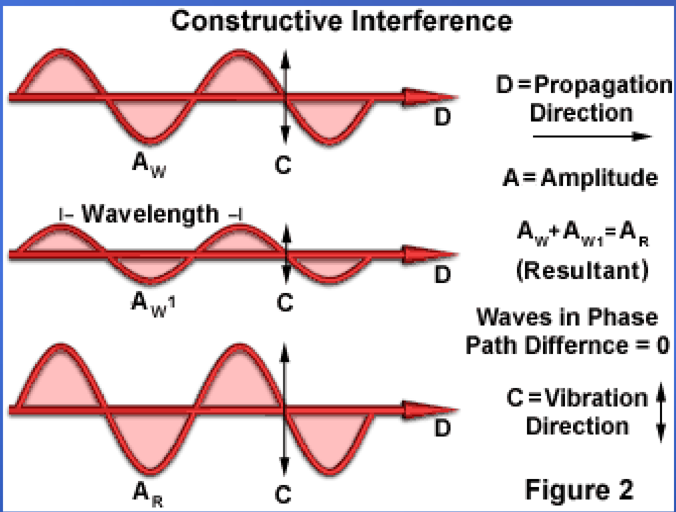
When two waves pass through each other they interfere with each other.

The principle of superposition states that the combined pulse at each point of interference is the algebraic sum of the displacements of the individual waves.

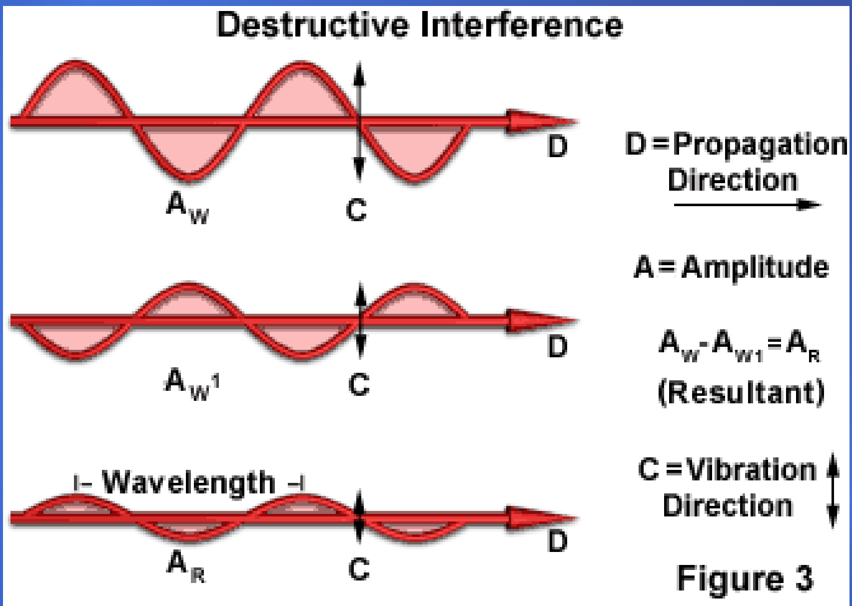


There are two types of interference that can occur.

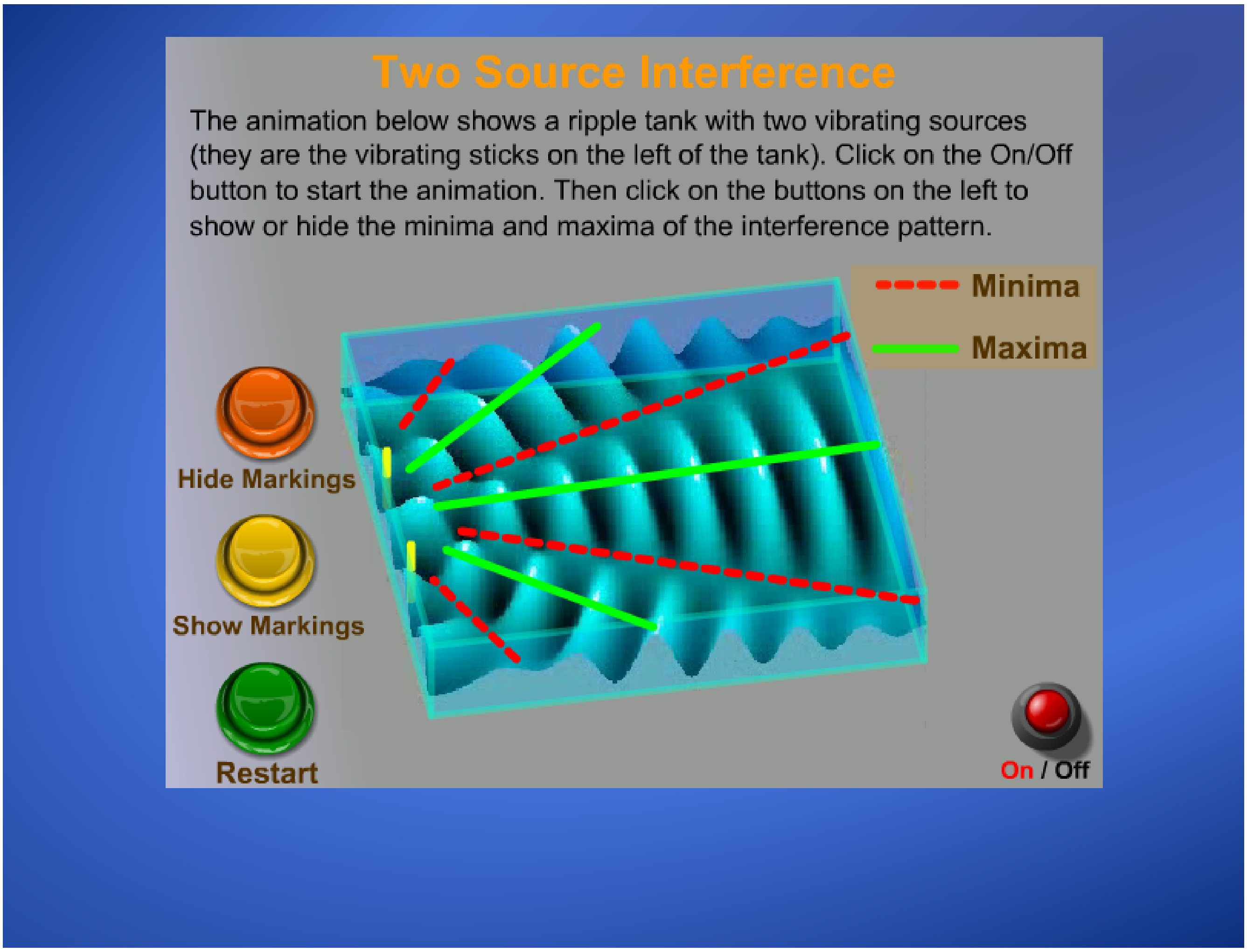
Constructive interfere: the displacement of the resultant pulse has a greater amplitude than the individual waves.



Destructive interference: the net amplitude of the resultant wave is less than the individual waves.



<ins>Interference patterns</ins> are patterns of constructive and destructive interference produced by the interaction of waves.


Two Source Interference
The animation below shows a ripple tank with two vibrating sources (they are the vibrating sticks on the left of the tank). Click on the On/Off button to start the animation. Then click on the buttons on the left to show or hide the minima and maxima of the interference pattern.
Minima
Maxima
Hide Markings
Show Markings
Restart
On / Off

Activity: Single Slit

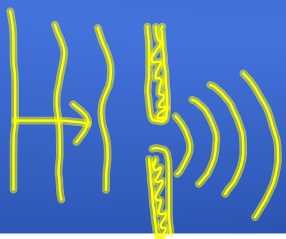
1. Set up a barrier in front of the point generator, such that there is a small gap through which the wave can travel.

- small gap
- shorter λ

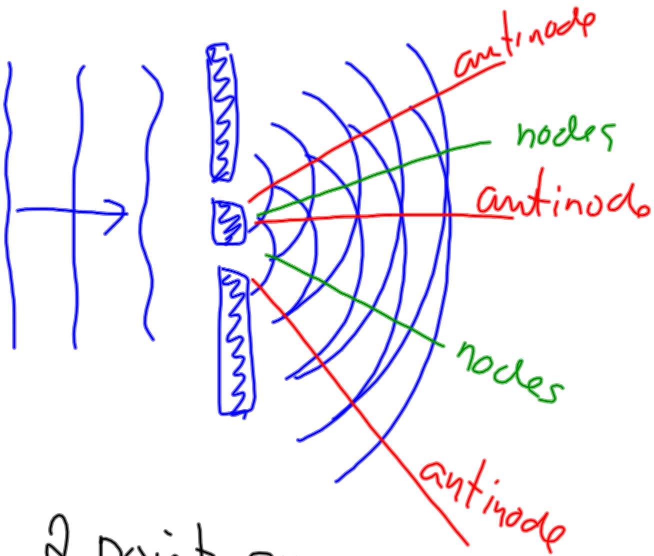
} more diffraction (bending)

- big gap
- longer λ

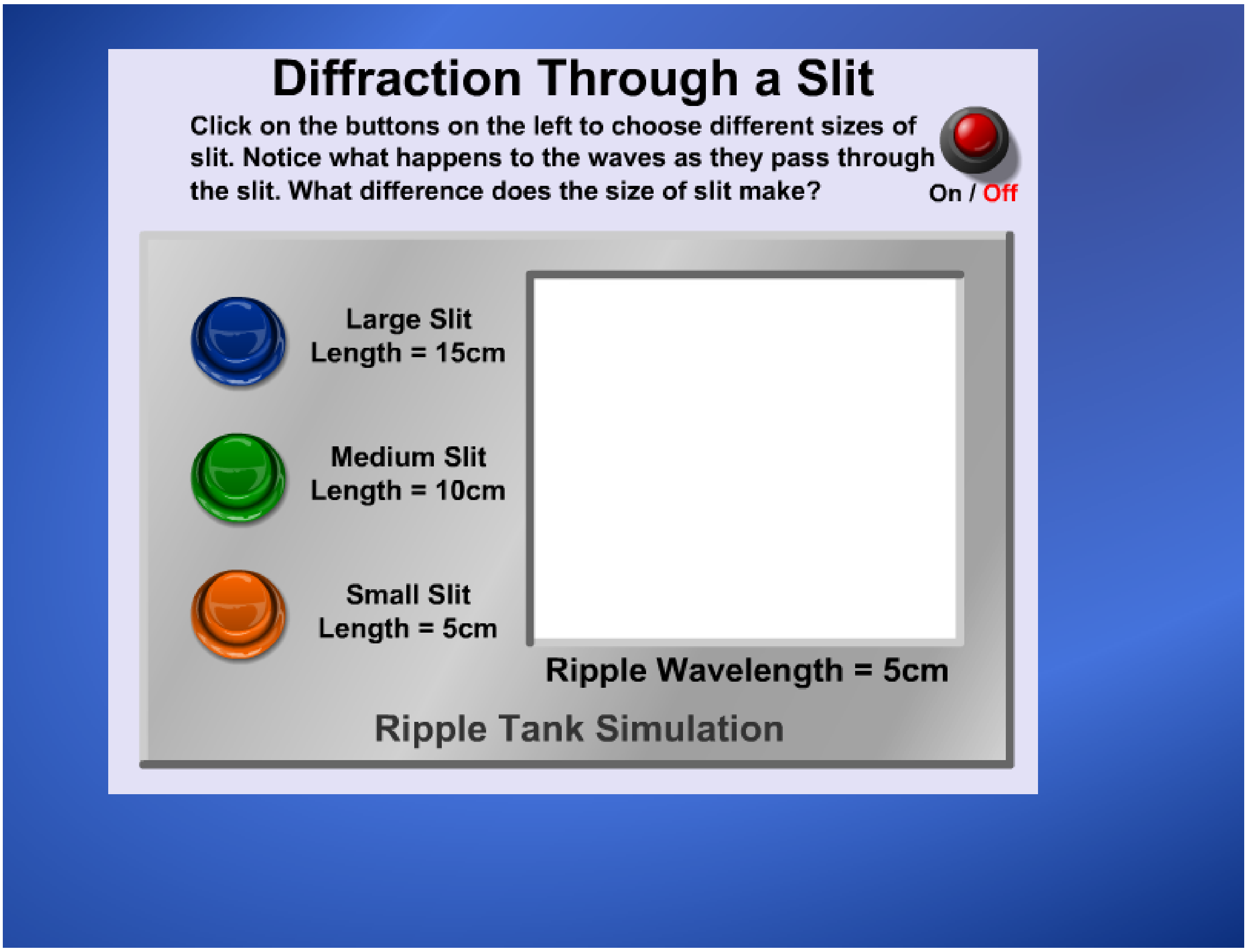
} less diffraction (bending)



2. Set up a barrier so that there are two small, identical gaps through which the wave can travel.



- Same as 2 point source interference pattern.


Diffraction Through a Slit
Click on the buttons on the left to choose different sizes of slit. Notice what happens to the waves as they pass through the slit. What difference does the size of slit make?
On / Off
Large Slit
Length = 15cm
Medium Slit
Length = 10cm
Small Slit
Length = 5cm
Ripple Wavelength = 5cm
Ripple Tank Simulation

When a wave passes through a small enough gap, it produces a wave as if it were a point source. The wave bends around the edge of the barrier. This bending of the wave is called diffraction.

Universal Wave Equation

frequency (Hz)

$$v = f\lambda$$

wavelength (m)

speed of the wave (m/s)

Example 8.2, p. 409

To generate waves in a stretched spring, you oscillate your hand back and forth at a frequency of 2.00 Hz. If the speed of the waves in the spring is 5.40 m/s, what is the wavelength?

$f = 2.00\ Hz$

$v = 5.40\ m/s$

$\lambda = ?$

$v = f\lambda$

$\lambda = \frac{v}{f}$

$\lambda = \frac{5.40\ m/s}{2.00\ Hz}$

$\lambda = 2.70\ m$

Practice Problems, p. 409 #1-3

~~8.2 eTest~~

2. $F = 325 Hz$
$\lambda = 4.71 m$
$t = 8.50 s$
$d = ?$

$v = \frac{d}{t}$

$d = vt$

$v = f\lambda$
$v = (325 Hz)(4.71 m)$
$v = 1530.75 m/s$

$d = (1530.75 m/s)(8.50 s)$

$d = 13011 m$
$\div 2$

$d = 6.5 \times 10^3 m$

3. $n = 8.0$
$t = 1.00 m$
$d = 250 m$
$t = 3.00 min$
$\lambda = ?$

$v = f\lambda$

$\lambda = \frac{v}{f}$

$v = ?$
$v = \frac{d}{t}$
$v = \frac{250 m}{180 s}$
$v = 1.39 m/s$

$f = \frac{n}{t}$
$f = \frac{8.0}{60.0 s}$
$f = .133 Hz$

$\therefore \lambda = \frac{1.39 m/s}{.133 Hz}$
$\lambda = 10 m$