17.3 Behavior of Waves

**Unit:** 5 - Waves

### Learning Objectives:

### Describe how reflection, refraction, diffraction and interference affect waves.

### State a rule that explains refraction of waves as it passes from one medium into another.

### Identify factors that affect the amount of refraction, diffraction or interference.

### Distinguish between constructive and destructive interference and explain how standing wave forms Language Objectives:

* Understand and correctly use the terms “Reflection”, “Refraction”, “Diffraction”, “Interference”, “Constructive Interference”, “Destructive Interference”, “Standing Wave”, “Node”, “Antinode”

### Notes: What is reflection?

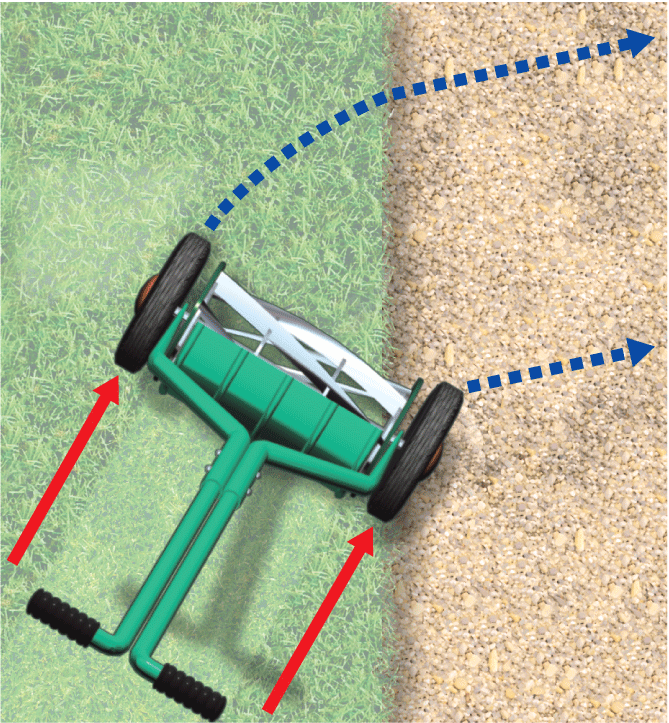
Reflection occurs when a wave \_\_\_\_\_\_\_\_\_\_\_ a surface that it \_\_\_\_\_\_\_\_\_cannot pass through.

Reflection \_\_\_\_\_\_\_\_\_ change the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a wave, but the wave can be flipped upside down.

**What is Refraction?**

Refraction is the\_\_\_\_\_\_\_\_\_\_ of a wave as it enters a new medium at an angle

**What causes the refraction of a wave when it enters a new medium?**

When a wave enters a medium at an angle, refraction occurs because one side of the wave moves more \_\_\_\_\_\_\_\_\_\_\_ than the other side

A lawnmower turns when it is pushed at an angle from the grass onto the gravel.

The wheel on the gravel slows down, but the other wheel is still moving at a faster speed on the grass

As an ocean wave approaches the shore at an angle, the wave bends, or refracts, because one side of each wave front slows down before the other side does.

An ocean wave refracts as it flows into a shallow area.

The shallower water can be considered a new medium.

As one side of each wave enters shallower water before the other, that side slows down and the wave bends.

If a wave front is parallel to the shoreline, the wave enters the shallower water all at once, and there is no refraction.

**What is diffraction?**

Diffraction is the bending of a wave as it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ an obstacle or passes through a \_\_\_\_\_\_\_\_\_\_\_\_opening.

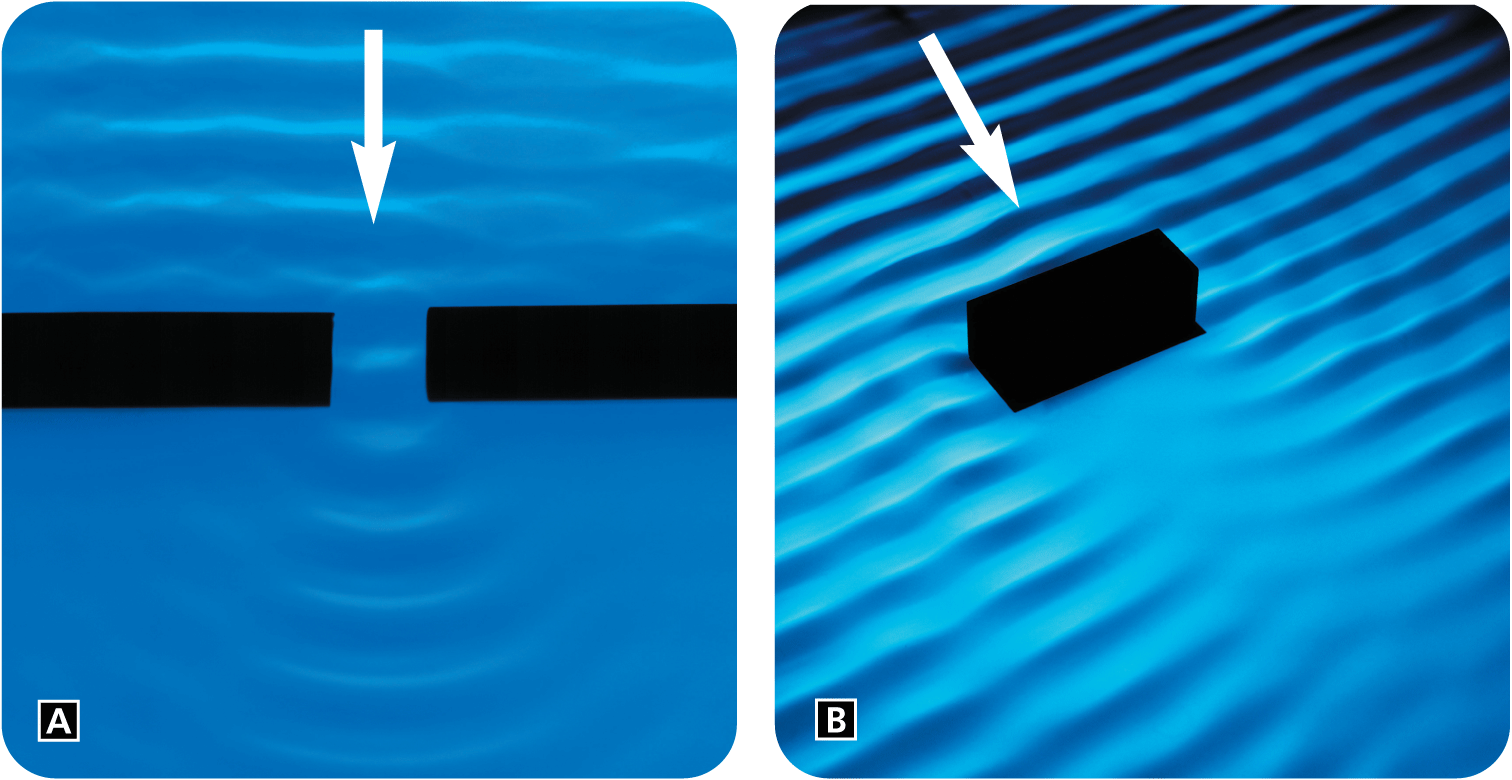
A wave diffracts more if its wavelength is\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ compared to the size of an opening or obstacle**.**

Water waves spread out as they pass through a narrow opening.

The pattern produced is very similar to the circular \_\_\_\_\_\_\_\_\_\_\_\_ you see when a pebble is tossed into a pond.

Diffraction also occurs when \_\_\_\_\_\_\_\_\_\_\_\_ around an obstacle.

The larger the wavelength is compared to the size of the opening or obstacle, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the wave diffracts

1. This wave diffracts, or spreads out, after it passes through a narrow opening.
2. Diffraction also occurs when a wave encounters an obstacle.

**What is interference?**

Interference occurs when two or more waves \_\_\_\_\_\_\_\_\_\_\_ and combine together.

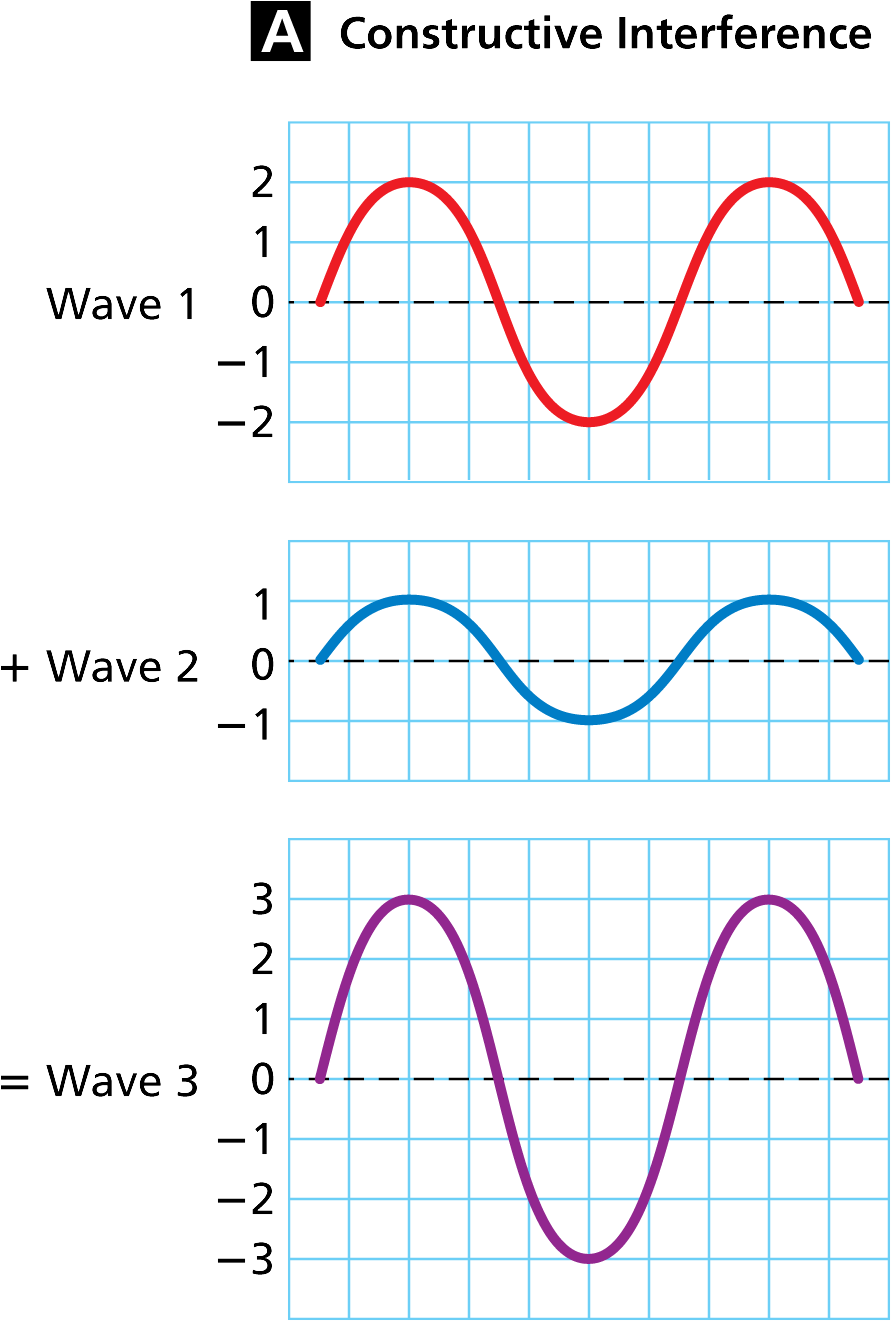
There are two types of interference:

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**More on Interference**

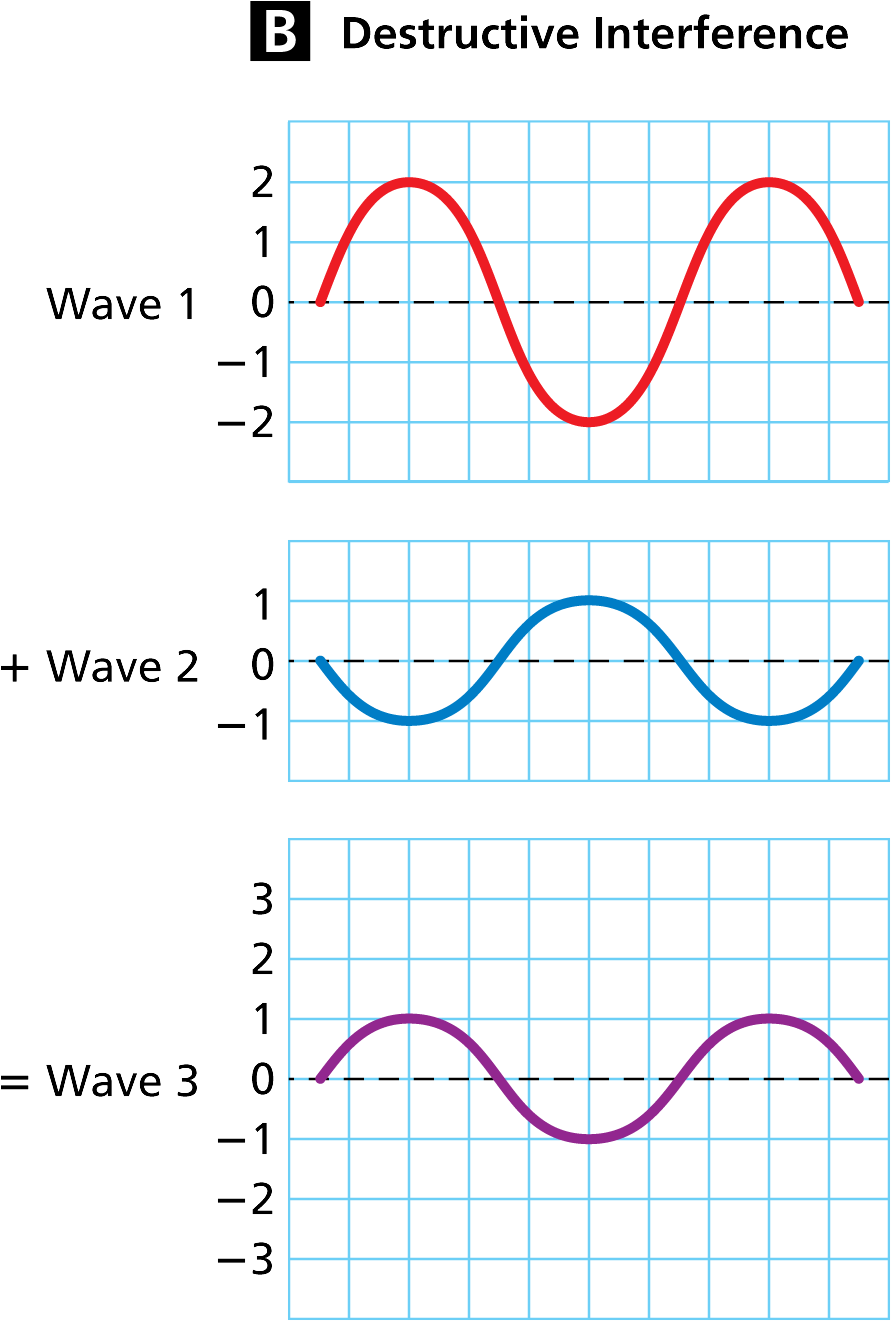
When waves collide, they can occupy the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of space and then continue on.

* + Constructive interference occurs when two or more waves combine to produce a wave with a \_\_\_\_\_\_\_\_\_\_ displacement.
  + Destructive interference occurs when two or more waves combine to produce a wave with a \_\_\_\_\_\_\_\_\_\_\_displacement.

**Constructive Interference**

Two waves with equal frequencies travel in opposite directions.

When a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the result is a wave with \_\_\_\_\_\_\_\_\_\_\_\_\_ amplitude.

**Destructive Interference**

Two waves with equal frequencies travel in opposite directions.

When a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the result is a wave with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ amplitude.

**What is a standing wave?**

A standing wave is a wave that appears to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_it does not seem to move through the medium.

A standing wave forms only if \_\_\_\_\_\_\_\_\_\_a wavelength or a \_\_\_\_\_\_\_\_\_\_\_\_ of half a wavelength fits exactly into the length of a vibrating cord.

Interference occurs as the incoming waves pass through the \_\_\_\_\_\_\_\_\_\_\_\_waves.

At certain frequencies, interference between a wave and its reflection can produce a standing wave.

**Node vs Antinode on a Standing Wave**

A node is a point on a standing wave that has \_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the rest position. At the nodes, there is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ interference between the incoming and reflected waves.

An antinode is a point where a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ occurs midway between two nodes.

These photos show standing waves for two different frequencies.

* 1. One wavelength equals the length of the cord.
  2. Two wavelengths equal the length of the cord.

