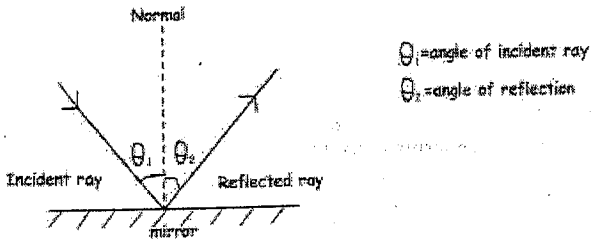
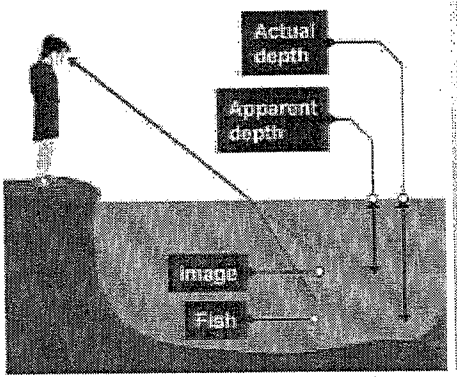
Types of Interference:

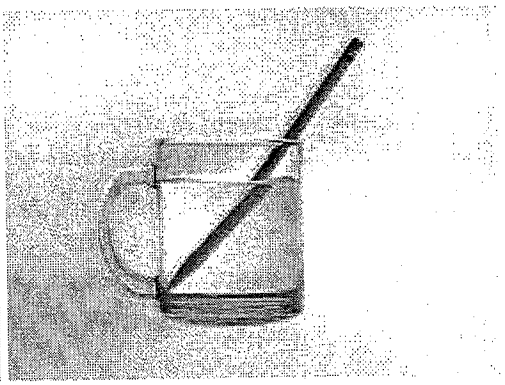
Reflection: When a wave hits a surface and can't pass through it _____ back. Examples: a ball thrown at a wall at various angles, looking into a mirror, shouting in a cave, etc.



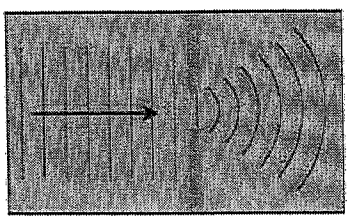
Have you ever been riding a skateboard and gone off the sidewalk into the grass or what about pushing a lawn mower down a driveway only to have one wheel catch the grass? What happens?

Refraction: When a wave enters a new medium (material) at an angle and one side of a wave changes speed before the other side. This causes the wave to _____. Bending occurs because two sides of the wave travel at different speeds. Examples: light striking water at an angle, light shining at a prism at an angle, trying to spear a fish underwater, etc. The effect of refraction is that it makes objects appear distorted and closer than they really are. When you go to reach for the object, you miss grabbing it.



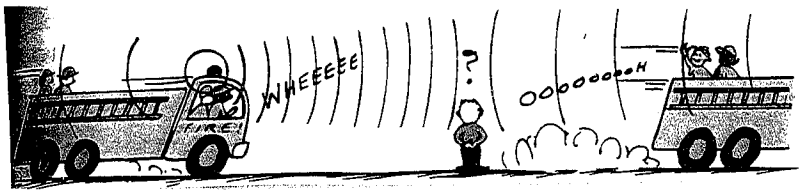


Diffraction: The bending of waves through a narrow opening or around a _____. Examples: diffraction of light waves producing a rainbow color on the underside of a cd, waves striking a jetty or groin or even shallow water and bending around the barrier, water passing through a narrow channel, etc.



Doppler Effect: The apparent change in frequency of a wave as its source moves in relation to an _____. The greater the speed of an object, the greater the Doppler effect. Water waves

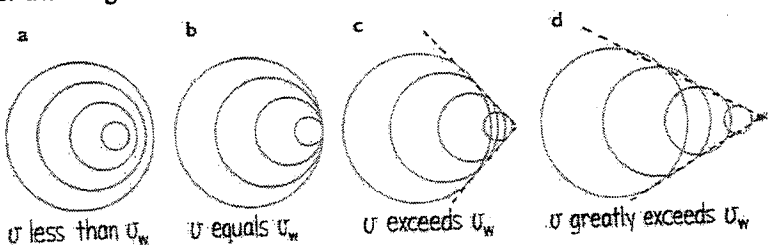
spread over the flat surface of the water. However, sound and light waves travel in three dimensions, spreading outwards in all directions. As the source moves towards you, there is a higher _____ because the waves stack up on each other but as the source moves past you, the pitch becomes _____ because the wave crests strike you less frequently. Examples: a race car at a race track, emergency vehicles passing by with their sirens going, radar used to monitor speed from a police officer's radar gun, etc.



◀ **Figure 25.17**
The pitch of sound is higher when the source moves toward you, and lower when the source moves away.

Doppler effect with light waves: when a light source approaches, there is an increase in its measured frequency which is called a _____ because the increase is toward the high frequency or blue end of the visible light spectrum. ROYGBIV A decrease in frequency is called a _____ because the less frequent waves refer to the low-frequency or red end of the visible light spectrum. Galaxy and star movements give off red or blue shifts which allow us to detect movement and speed.

Bow waves:
Occur in water and are _____. They are produced by overlapping circular waves that form a V. Bow waves are an example of constructive interference which produce big increases in amplitude. Bow waves occur because some object is traveling faster than the wave speed. Can you think of an object in water that might make a bow wave?



Shock waves:
Are similar to bow waves but they occur in air and are _____. A sonic boom is the result of a shock wave produced by a supersonic aircraft. We don't hear the sharp crack or sonic boom from an aircraft flying at less than the speed of sound (340 m/s) because the sound wave crests reach our ears one at a time. Only when the aircraft travels faster than the speed of sound do the wave crests pile up and create the single burst of noise. It is important to note that it is not necessary for a moving source to emit a sound for it to produce a shock wave. A whip and a towel don't produce noise on their own but if you crack or snap them quickly, they travel faster than the speed of sound and a mini sonic boom results.

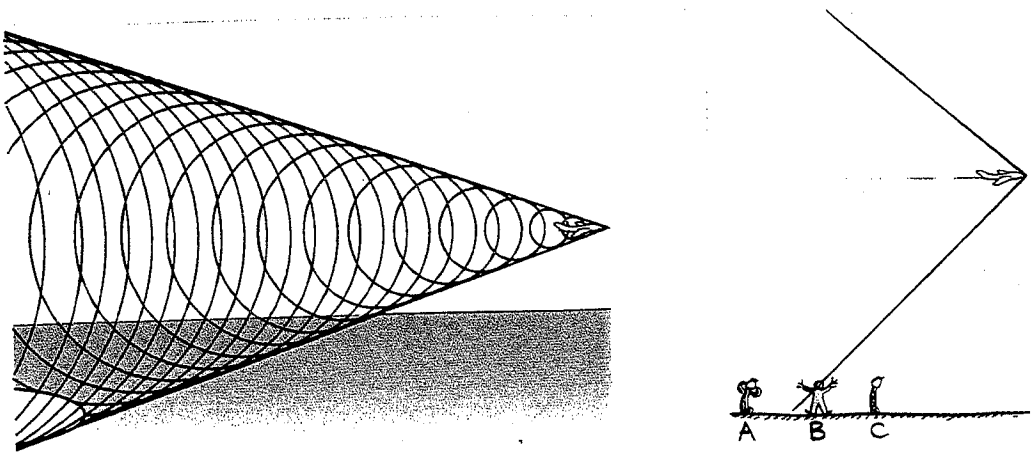


Figure 25.23 ▲
The shock wave has not yet encountered listener C, but is now encountering listener B, and has already passed listener A.