**Video Clip Guided Notes: Wave Interference**

All waves can be distorted, deflected, or changed when they come in contact with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It is comparatively easy to see these effects with both water waves and sound waves, but even \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ waves are influenced by distortions.

Reflected waves change \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when they bounce off a barrier. We have all heard sound echoes and understand that it occurs when sound waves are reflected off a building or a cliff face. When sound travels through a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ like air, and strikes another medium, like this canyon wall, some of the sound will reflect back to us in an echo. \_\_\_\_\_\_\_\_\_\_\_\_\_ uses this same principle by transmitting sound waves through the water and timing the echoes that come back, in order to create an image of the ocean floor. Dolphins use sonar \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to hunt for food.

Reflection also works for other types of waves. These waves of water are being reflected off the rocks. Mirrors reflect light, and we are able to see because of the reflection of electromagnetic waves. When light reflects off objects, those objects become visible to our eyes.

This pencil appears to be broken at the water line. This is due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_. Electromagnetic waves travel \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in air than they do in water and as a result, when they go from one medium to another the image appears bent, because the light ray deviates from its normal location. Refraction is the basis of lens technology. Also it occurs with sound waves and all other waves.

Diffraction is the term used when waves \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ around the edges of objects. This is why we can hear around corners. Light waves can also be diffracted and this phenomenon was put to use in the lens technology for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in lighthouses.

Wow! That car horn had a high pitch as it approached and a lower pitch as the car retreated down the street. That is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. If the car was standing still the sound waves would travel at the same speed and the sound of the horn would have a constant pitch. But as the car comes toward us, each successive sound wave travels a shorter distance to reach our ears. The waves arrive at us more frequently and thus have a higher pitch. As the car travels away from us, each successive wave travels a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ distance to reach our ears, and produces a \_\_\_\_\_\_\_\_\_\_\_\_\_ pitch.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ also exhibit the Doppler effect. In the 1920s, an American astronomer named \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ observed that the colors of the stars in other galaxies were similar to those in our own, but with one big exception; the colors were all shifted a little towards the \_\_\_\_\_\_\_\_\_ end of the color spectrum. Hubble realized that the reason for this is that the distance between other galaxies and our own had actually \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ while the light from the stars had been traveling. In other words, the wavelengths of the light had been stretched over a longer distance and therefore the wave frequency had been lowered, just as it does for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sound waves. This discovery is the reason astronomers and physicists have concluded that the universe is expanding.

Any object, like this wine glass, will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and produce waves when it is disturbed. This is called its natural \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When one tuning fork is rung, and brought close to another of the same frequency, the second fork begins to vibrate in harmony with the first one. It continues to ring even when the first fork is removed. This is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and always results in an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in amplitude.

When two waves meet while traveling in the same medium, wave \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ occurs. If the displacement is in the \_\_\_\_\_\_\_\_\_\_\_\_\_ direction, both up or down, it becomes constructive interference and the amplitude \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ temporarily as they pass each other. When sound waves are nearly the same they complement each other to produce a louder sound. This often happens when musical instruments are played together. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ interference occurs when waves overlap and the displacements are in the opposite direction. This can result either in silence or a softer sound than would be produced by the original waves. A standing wave can arise when two waves \_\_\_\_\_\_\_\_\_\_\_\_. It occurs when waves of identical frequency, traveling in opposite directions, combine. In that situation, nodes are created where no movement of the medium occurs. In music these unique frequencies are called harmonics and overtones, which make the sound more aesthetically pleasing.

Architects and engineers apply the physics of sound in order to design buildings with good acoustics, and musicians learn how the sound is created in their instrument so they can maximize its effect.

Constructive and destructive interference can have an effect on all waves. The most common interference in radio or television waves occurs when two signals overlap. Usually what happens is the frequencies are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and they interfere with each other. The more physicists have learned about the nature of waves, the more they have come to understand the fundamental function waves play in the universe.