Waves

Sound waves are when a sound leaves someone's mouth and then is transferred through the air.
One air molecule bumps into another air molecule until the sound of something reaches another person's ears, like dominos.
You don't sound what other people hear you like because in order for a sound to be transmitted, it has to go through a medium. (An example of a medium is air). Most of the sounds that you hear of yourself are transmitted through the jawbone, it doesn't all go to the air and the come to your ear, most of it doesn't leave you in the first place. But other people hear it all coming through the air.
Helium is a different medium than air, so the sound is different.
Waves can travel in different waves.
Longitudinal; The transmission is horizontal and the vibrations are along that horizontal path.
Transverse; When the transmission is one way, but the vibrations are cutting through that path of transmissions perpendicularly.
Vibrations are parallel to the direction of energy movement in a transverse.
But if there are waves that are coming towards each other at the same time, there is an interaction. If the waves meet each other while going both to the right, that wave would be two times as big as it normally would. But if they met while one was going to the right and the other to the left, they would cancel each other out.
The two phases of a water wave is a crest and then a trough.
If you were in a canoe and there were waves coming on either side of you, if there was a crest on one side and a trough on the other, you wouldn't move. But if it was both troughs or both crests, then there would be a more extreme movement.

Vibrations
You can have two objects that are the same, and when one is hit, and the other one is hit, they will produce the same sound.
But you can adjust one of them to make them different, and they can produce a different sound.
You can also adjust them again so that they're the same but if you hit them at different times, you hear the difference in their vibrations, they're off sync.
Q; What is the locus of points of constructive interference and destructive interference?
Locus; the location of
Constructive Interference; points where the waves meet in phase [sync].
Destructive Interference; where the crest of one meets the trough of the other and vice versa. Out of phase.
In the experiment with the beads and the water, there were dead spots where there were lines of water that weren't really affected by the vibrations, that's where a crest met a trough and they cancelled each other out.
The speed of sound is slower than the speed of light.
If you're at a baseball game, you see the player start to run to first base before you hear the crack of the contact between the baseball and baseball bat, because the speed of light travels faster than sound.

One wavelength of distance takes a period to travel.

A wave has a crest phase and a trough phase.
Just like if someone comes late to school and they come for the beginning of period 4, they're still in sync with everyone because everyone else is also going to period 4. But if someone comes in the middle of a period, they're out of sync with everyone else.
As long as it's a whole number late, it's still in sync.
A wave is when a point makes its way to the next corresponding point (in a sin or cos curve).

Q; There are two waves that are headed to the same point P. It takes one of them 19 meters to reach the point, and the other 34 meters to get there. Given that a wavelength is 6 meters, is the second wave going to be in sync or out of sync with the wave that reached the point first?
No because it took the 34 meters an extra 15 meters for it to come to the same point that it took the 19 meters. That means it didn't take one full wavelength so it came out of sync. It took two and a half wavelengths, so it didn't come on time.
Therefore it's a Destructive Interference.

<u>Constructive</u>

$$\Delta \square = \square \square$$

Where l is the extra distance, n is a whole number integer and $\lambda$is the wavelength.

<u>Destructive</u>

$$\Delta \square = \left(\frac{\square}{2}\right) \square$$

Q; Why does sound travel faster in water than in air?
Because the particles are much closer together in water so it takes less time for the particles to collide and move the sound through the medium.
The same goes for steel. It moves much faster in steel than in air because steel is denser than air.

If sound [which needs a medium] goes through something denser than air, it will move faster. When light goes through water, it's more difficult for it because light doesn't need a medium. It can travel through nothing, doesn't necessarily need air. So light travels slower than sound from our perspective because we are always in the presence of air.
Therefore, [in air] sound travels faster than light.
Light travels 33% percent slower than sound.

The bending of light as it passes obliquely (not head on) is called a <u>refraction</u>.
If there is light going somewhere normally and it switches perpendicularly, there is no change because they are both making an angle of 90 degrees.

Q; Light passes from air into water at an angle of 30 degrees and a wavelength of 5.89×10^{-7}

1. **What is the speed of the light in air?**

The speed of the light in air is 3×10^{8}. This is on the front page of the reference table. No matter what the light was or what wavelength it has, it always travels at that speed. It's the ultimate constant in nature.

2. What is the frequency of the light in air?

Using the formula □ = □□, divide both sides by λin order to get □alone. You get 5.09×10^{14}□□

3. What is the color of the light in air?

Use the electromagnetic spectrum, and put your answer in for frequency. You get that it's yellow.

4. What is the speed of light in water?

Use the formula of $\frac{□1}{□2} = \frac{□1}{□2}$and x would be in place of the velocity on the bottom. N is the absolute indices of refraction on the reference table and you already have the speed of the light in air. Plug that all into the formula. 2.256×10^{8}meters per second.

5. What is the frequency of the light in water?

The frequency doesn't change so it's the same as it would be in air.

6. What is the wavelength of the light in water?

Use the formula of $\frac{□1}{□2} = \frac{\lambda 1}{□2}$and plug in everything except the second wavelength. That becomes the unknown. The answer is 4.4×10^{-7}.

7. What is the color of light in water?

The color stays the same. The color is yellow because the color is dependant on frequency and the frequency doesn't change.

8. What is the angle the light makes in the water?