Station 1: Hearing

“Write responses in your notebook.

1. Hank had damage to the shorter hairs in his cochlea. How will this affect his hearing? Will he be able to hear at all? What kinds sound will he have difficulty hearing?
    a. High pitch. Smaller hairs have higher natural frequencies
2. Jimbo damaged his eardrum. Is a cochlear implant the correct treatment? Why or why not?”
    a. The hairs are not damaged, he should fix the drum.

Station 3: Practice calculations

3. A 680 Hz sound wave travels at 340 m/s in air.
    a. What is the frequency?
    b. What is the velocity?
    c. What is its wavelength?
4. An oceanic depth-sounding ship surveys the ocean bottom with ultrasonic sound that travels at 1530 m/s in sea water. They find a 20 s delay of the echo to the ocean floor and back. What is the depth?
5. For the same scenario as 2, how much of a delay will there be when the ocean is only 3060 m deep?
6. A sky scraper swings at a frequency of 0.2 Hz. How long does it take to sway back and forth one time? What are you trying to find in this problem?
7. The crests on a long surface water wave are 20 m apart, and in 1 minute 10 crests pass by. What is the speed of the wave?
8. If the moon blew up, why wouldn’t we hear it?
9. How does the electromotive brain transducer 3000 use resonance?

Answers for station 3:

1. 680 Hz, 340 m/s, 0.5 m
2. 15300 m
3. 4 s
4. 5 s Period
5. 200 m/minute or 6.67 m/s
6. There is no medium for the pressure wave to move through, so the sound won’t transmit to us.
7. Each pendulum has a different natural frequency. By oscillating the pencil at one of these frequencies, we get one of the pendulums to resonate. This is why only one pendulum moves much at a time – only the one with that natural frequency.
8. Sound needs air to travel, in space there is no air so the sound of the moon exploding cannot travel to earth.

9. If you move the pencil at the fundamental frequency of one of the strings that string will move. The other strings will not because they are different lengths and therefore have different fundamental frequencies.

Station 4: Patterns

$T = \frac{1}{f}$ $v = v$ $\lambda = \frac{v}{f}$ $v = f\lambda$

Select the correct pattern from above and draw a graph showing the following relationships:

10. Shaking a slinky at different frequencies, measuring wavelength.
    a. $\lambda = v / f$ → inverse
11. Shaking a single slinky at different frequencies, measuring wave speed.
    a. v = v → velocity does not change unless you change the medium (ie use a different slinkey) → horizontal
12. Shaking multiple slinkies at the same frequency, measuring velocity and wavelength.
    a. $v = \lambda \cdot f$ → Linear
13. Shaking a slinky at different frequencies, measuring period.
    a. $T = 1 / f$ → Inverse

Station 5: Light

Record your answers to the following in your notes:

14. What does a spectrometer show you when you use it to look at a light source?
    a. It splits the light and shows you the different wavelengths of color that exist in the source light
15. Describe one way that we know light must be a wave.
    a. Young's double slit experiment. Light shown through two tiny slits interference with itself causing an interference pattern, only a wave could do that.
    b. Scientist shown a light at a nanowire (a tiny little wire) and the light bounced back and forth creating standing waves. Scientists were able to take a picture of the standing waves proving that light is a wave.
16. Describe one way that we know light must be a particle.
    a. The Photoelectric effect: when you shine a light at metal the light bumps electrons off of the metal. The only way light could bump electrons is if it were a particle.

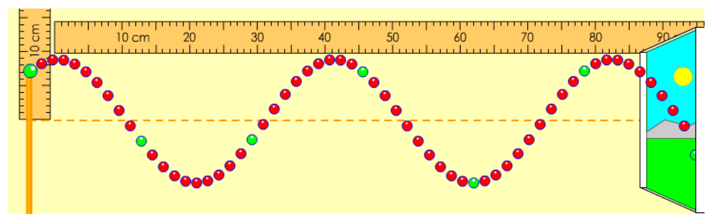
b. In the experiment from 15 b the scientists fired electrons past the wire and found that the light bumped into the electrons causing them to move. The only way light could do that was if it were a particle.

17. How is it that one article on light stated that light cannot be a particle and a wave at the same time and another article stated that they had taken a picture of light acting as a wave and a particle at the same time?

a. Scientific theories develop and change as new observations are made. Scientists thought light could not be a wave and a particle at the same time until they were able to observe it being both at the same time. Now the theory can change and grow.

Station 6: Waves property practice

18. Label the wave to the right with these terms: wavelength, amplitude, crest, trough.



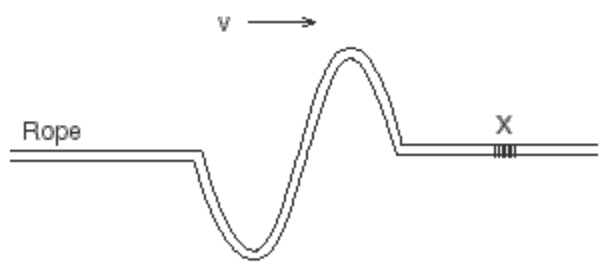
19. Sketch what the wave would look like if it oscillated twice as fast.

a. Frequency will increase so the wavelength will decrease because the velocity will stay constant.

20. How could you make the wave travel faster?

a. the only way to change the velocity of a wave is to change the medium (material) the wave travels through. You can do this by switching to a new string or changing the tension.

21. As shown in the diagram to the right, a transverse wave is moving with velocity v along a rope. In which direction will the segment marked with an X move as the wave passes through it?



a. Any given spot on a string will oscillate up and down as the wave travels through it.