Physics Virtual Labs/Simulations

Name: _____

Modules:

1. Section 25.8: Standing Waves
2. Section 25.9: Doppler Effect
3. Sections 25.10 and 25.11: Bow Waves and Shock Waves

Module 1: Standing Waves

Reading: Section 25.9 (p500 – 501)

Concept: *A standing wave forms only if half a wavelength or a multiple of half a wavelength fits exactly into the length of the vibrating medium. Only certain frequencies produce standing waves; Standing waves can have a wave length λ = to the length of the string L, 2L, or 2/3 L. (2 nodes = ½ λ = 2L; 3 nodes = 1λ = L; 4 nodes = 1.5 λ = 2/3L)*

1. Visit http://www.walter-fendt.de/ph14e/stwaverefl.htm,
2. Select from a fixed-end, select incidenting wave, reflected wave and resulting standing wave. Select T/8 in the drop box.
3. Let the simulation run.
4. Describe the process that creates an anti-node.

   _____
   _____
   _____

5. Describe the process that creates a node. _____
   _____
   _____

6. Pause the simulation, and count the number of wavelengths that you observe on the length of the vibrating wavelength. _____

7. Repeat step 6 for selections T/4, T/12, and T/24. _____
   _____
   _____

8. Summarize your observations with respect to the above concept.

Module 2: The Doppler Effect Introduction (non-mathematical)

Reading Section 25.9

Concepts: *As a wave source approaches, an observer encounters waves with a higher frequency. As the wave source moves away, an observer encounters waves with a lower frequency.*

Visit: www.colorado.edu/physics/2000/applets/doppler.html,

1. Take a few minutes to explore the applet by moving the curser. This applet will model sound waves moving through the medium of air.

2. Adjust the cursor so that the police car is moving forward. Sketch the result and describe what is happening to the waves in front of the police car and behind the police car.

3. From your sketch above, describe what is happening to the frequency of the waves in front of the police car and behind the police car. Assume that v is constant and $v = \lambda f$. _____
   _____
   _____
   _____
   _____

4. Imagine that a person is standing in front of the police car. The sensation of frequency is "pitch." What kind of pitch will the person "hear?" Explain
   _____
   _____

   What if the person was standing behind the police car? _____
   _____
   _____

5. What was Doppler's first name? _____

Module 3: Bow and Shock Waves

Reading: Sections 25.10 and 25.11

Concept:

- *A bow wave occurs when a wave source moves faster than the waves it produces.*
- *A shock wave occurs when an object moves faster than the speed of sound.*

Visit: http://www.grc.nasa.gov/WWW/K-12/airplane/sndwave.html,

1. Take a few minutes to play the applet.
2. What is the "Mach" number? _____
   _____
3. Explain what subsonic, transonic, and supersonic mean. _____
   _____
   _____
   _____
   _____
4. Adjust the airplane's speed to Mach 0.5. Describe the position of the airplane when "sound" is detected.
5. Adjust the airplane's speed to about Mach 1.0. Describe/sketch the shape of the sound waves in front of the plane and behind the plane. _____
   _____
   _____
   Describe the position of the airplane when "sound" is detected.
   _____
   _____
   _____
   _____
6. Adjust the airplane's speed to about Mach 1.5. Describe/sketch the shape of the sound waves in front of the plane and behind the plane.
   _____
   _____
   Describe the position of the airplane when "sound" is detected. _____
   _____
   _____
   _____
7. Distinguish between supersonic and ultrasonic. _____
   _____
   _____

Visit https://engineering.purdue.edu/~wassgren/applet/java/machcone/Index.html,

1. Load the applet and take a few minutes to familiarize yourself to it.
2. How is the Mach number being calculated? Note: "c" is usually reserved for the speed-of-light; in this case it refers to the speed-of-sound.

3. Set the Mach # = 0.5. Stop the applet and sketch the patterns of the wave.

4. Set the Mach # = 1.0. Stop the applet and sketch the patterns of the wave.

5. Set the Mach # = 1.5. Stop the applet and sketch the patterns of the wave.

6. Set the Mach # to over 2.0. Stop the applet and sketch the patterns of the wave.

8. Distinguish between bow waves and sock waves. Sketch ok.