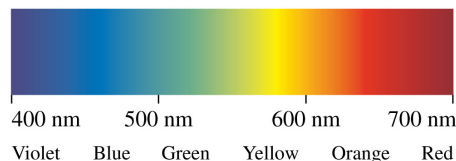


PHYS 234: Recitation 6  
(Quiz: Mar 4, 2020)

Note: For these problems you may take the speed of sound in air to be 343 m/s.

1. **Estimation:** When the island of Krakatoa was destroyed by a volcanic eruption, the sound waves could be detected worldwide. How long would it take for such a wave to travel around the earth and come back to Krakatoa? *Clearly state your assumptions and how you came to the numbers you estimate.*

2. **Essay:** The speed that an astronomical object is moving away from us is estimated using its “redshift.” Explain the meaning of the name redshift, how it is related to the Doppler effect, and why we never worry about a “blueshift.” The visible light spectrum is provided as a guide.

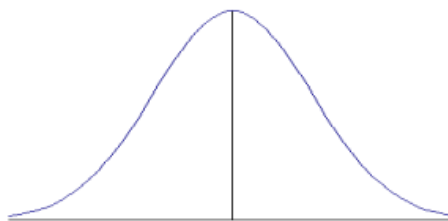


3. A. How long does it take light to travel one mile?

B. How long does it take sound to travel one mile?

C. If you hear thunder 8 seconds after a lightning strike, how far away was the lightning?

4. The figure shows the shape of a pulse on a stretched string at the time  $t = 0$ . The pulse is moving in the positive  $x$  direction with a velocity  $v_0$ . The displacement of the string from its equilibrium position at time  $t = 0$  is given by  $f(x) = A \exp(-x^2/b^2)$ .



A. Sketch a graph showing the shape of the string at a later time  $t = t_0$ . On the graph, specify the height and the position of the peak in terms of  $v_0$ ,  $A$ ,  $b$ , and  $t_0$ .

B. Write an equation for the displacement of any portion of the string at any time,  $y(x,t)$ .

C. Sketch a graph of the vertical velocity  $v_y$  of the portion of string at the position  $x = 2b$  as a function of time  $t$ .

D. Sketch a graph of the horizontal velocity  $v_x$  of the portion of string at the position  $x = 2b$  as a function of time  $t$ .

5. A train whistle is heard at 290 Hz as the train approaches town. The train cuts its speed in half as it nears the station, and the whistle is then heard at 280 Hz. The speed of sound in air is 343 m/s.

- A. What is the speed of the train before slowing down?
- B. What is the speed of the train after slowing down?
- C. What is the frequency of the train whistle?