

**Physics 103 Quiz #10, Thursday (4/4/2013)**

Show all work in order to obtain points for problems

Name: \_\_\_\_\_

1. (2 pts) The speed of sound at 0°C is 331 m/s. What is the speed of sound at 25°C? (0°C = 273 K)

- a. 346 m/s  
 b. 356 m/s  
 c. 343 m/s  
 d. 350 m/s

$$V = 331 \text{ m/s} \sqrt{\frac{298}{273}} = 346 \text{ m/s}$$

$$V = 331 \text{ m/s} \sqrt{\frac{T}{273}} \leftarrow K$$

2. (2 pts.) How far away is a lightning strike if you hear the thunderclap 3.00 s after you see the lightning bolt strike? ( $v_{\text{sound}} = 340 \text{ m/s}$ ,  $v_{\text{light}} = 3 \times 10^8 \text{ m/s}$ )

- a. 113 m  
 b. 340 m  
 c. 680 m  
 d. 1 020 m

$$x \approx v_{\text{ot}} \\ \approx 340 \times 3 \\ \approx 1020 \text{ m}$$

exact

$$x = v_{\text{e}} t_{\text{e}} \quad t_{\text{s}} - t_{\text{e}} = 3$$

$$x = v_{\text{s}} t_{\text{s}}$$

$$0 = v_{\text{e}} t_{\text{e}} - v_{\text{s}} t_{\text{s}}$$

$$= v_{\text{e}} (t_{\text{s}} - 3) - v_{\text{s}} t_{\text{s}}$$

$$0 = t_{\text{s}} (v_{\text{e}} - v_{\text{s}}) - v_{\text{e}} 3$$

3. (4 pts.) The intensity level of sound 20 m from a jet airliner is 120 dB. At what distance from the airplane will the sound intensity level be a tolerable 100 dB? (Assume spherical spreading of sound.)

- a. 90 m  
 b. 120 m  
 c. 150 m  
 d. 200 m

$$\frac{I_1}{I_0} = \frac{P}{4\pi r_1^2}$$

$$I_2 = \frac{P}{4\pi r_2^2}$$

$$B_2 - B_1 = 10 \log (I_2/I_0) - 10 \log (I_1/I_0)$$

$$= 10 \log (I_2/I_1)$$

$$100 - 120 = 10 \log (r_1^2/r_2^2)$$

$$-2 = \log r_1^2/r_2^2$$

$$10^{-2} = r_1^2/r_2^2 \Rightarrow r_2 = r_1(10) \\ = (20)(10) \\ = 200 \text{ m}$$

$$t_{\text{s}} = \frac{v_{\text{e}} 3}{v_{\text{e}} - v_{\text{s}}} \\ = \frac{3}{1 - v_{\text{s}}/v_{\text{e}}}$$