Physics 221
Quiz #3

Names: _____

1. Compare and Contrast the Doppler Effect and a Sonic Boom.
    a. Do the actual sounds heard have something in common? Specifically explain what we perceive in each case and how these are different or similar.

    b. How about the underlying physics, how closely related are they (use diagrams to support your answer)? First describe how each works and then show how the physics is similar or different.

2. A particular speaker at a concert puts out 20 Watts of power.
    a. Calculate both the intensity and the intensity level at 3 meters.

    b. If there were two identical speakers next to each other, by how much would the intensity level increase?

c. Determine how far you must stand from the speaker to receive an intensity level equal to 90 dB which is safe for approximately 2 hours exposure?

3. On a very cold day, -10°C, Walter is driving down the road at 15 m/s and sees a car that is honking its horn. Walter has perfect pitch along with training to help him recognize exact frequencies. He identifies the frequency of the sound he's hearing at exactly 457 Hz. It's a blizzard so he is having a hard time telling if the car is moving, much less if it's moving towards or away from him. Since he also happens to know that this particular make of car puts out a frequency of 425 Hz from its horn, since we know Walter is great with numbers he calculates in his head the car's exact speed to distract himself from the tense driving conditions.
   a. What is its speed?
   b. Is the car moving towards or away from Walter?

$f' = f \frac{v \pm v_o}{v \pm v_s}$, + observer moving towards, - observer moving away, - source moving towards, + source moving away.

$v = 331$ m/s $\sqrt{1 + \frac{T}{273}}$ T in degrees C $I = \frac{P}{4\pi r^2}$ $\beta = 10 \log \left(\frac{I}{I_o}\right)$ $I_o = 1 \times 10^{-12}$ W/m²