

Music, Beats, and Doppler Effect Practice Worksheet

Unless stated otherwise, assume that $T = 20^{\circ}\text{C}$.

1. A tuning fork of frequency 262 Hz is sounded at the same time as another tuning fork with a frequency of 257 Hz. What is the beat frequency that is heard?

Answer: $f_b = 5 \text{ Hz}$

2. A tuning fork with a frequency of 432 Hz is sounded at the same time as a guitar. If 6 beats are heard in 3 seconds, what are the possible frequencies of the guitar string?

Answer: $f = 430 \text{ Hz or } 434 \text{ Hz}$

3. On a cold wintry day, Bob is late for work. He drives at a speed of 15 m/s toward the factory where he works. The factory whistle is blown with a frequency of 800 Hz to indicate the start of the workday. If it is -4°C ...

- a. What is the frequency that Bob hears when the whistle is blown?

Answer: $f' = 837 \text{ Hz}$

- b. What is the frequency that Bob hears when he passes the building and moves away toward the parking lot behind the factory?

Answer: $f' = 763 \text{ Hz}$

4. While standing near a railroad crossing, a person hears a distant train horn. According to the train's engineer, the frequency of the horn is 262 Hz. If the train is traveling at 20.0 m/s toward the crossing and the speed of sound is 346 m/s...

- a. What would the train horn's wavelength be at rest?

Answer: $\lambda = 1.32 \text{ m}$

- b. By how much would the horn's wavelength change as a result of the train's motion?

Answer: $\Delta\lambda = 0.075 \text{ m}$

5. An ambulance with a siren emitting a whine at 1300 Hz races by a car that was pulled off to the side of the road. After being passed, the driver of the park car hears a frequency of 1220 Hz. How fast was the ambulance moving?

Answer: $v_s = 22.5 \text{ m/s}$

6. In 1845, French Scientist B. Ballot first tested the Doppler shift. He had a trumpet player sound an A, 440 Hz, while riding on a flatcar pulled by a locomotive. At the same time, a stationary trumpeter played the same note. If the locomotive was moving toward Ballot at a speed of 5.0 m/s, what beat frequency would Ballot have heard?

Answer: $f_b = 6.5 \text{ Hz}$