**Doppler Effect Problems Like 12.2**

A. Doppler Problems: (Use **343 m/s** as the speed of sound.)

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|  | Moving Source:  Moving Observer:  |
| 262.2 Hz | 1. A car with a horn frequency of 240 Hz approaches you at 29 m/s. What frequency do you hear? |
| 136.1 Hz | 2. A person hums at 150 Hz while driving away from you at 35 m/s. What frequency do you hear? |
| 344.6 Hz | 3. Your dad is singing at 356 Hz, and you run away from him at 11 m/s. What frequency do you hear? |
| 995.5 Hz | 4. You are riding on a train going 45 m/s. As you approach a crossing, there is a bell with a frequency of 880 Hz. What frequency do you hear? |
| 187.3 Hz | 5. A salsa band is running away from you at 14 m/s. If you hear a pitch of 180 Hz, what frequency are they really playing? |
| 390.6 Hz | 6. You hear a pitch of 420 Hz as a car with a man standing on the roof playing a flugelhorn approaches you at 24 m/s. What frequency is the man really creating?  |
| 442.5 Hz | 7. You are riding a rocket-propelled skateboard at 57 m/s toward a television playing a Lawrence Welk re-run. If you hear a pitch of 516 Hz, what is the real pitch the television is making? |
| 92.7 Hz | 8. You are in a motorboat going 21 m/s away from a foghorn. You hear it at a pitch of 87 Hz, so what pitch is it really creating? |
| 10.8 m/s away | 9. If you hear a frequency of 253 Hz as you listen to a middle C (261 Hz) being played on a piano that is on a flatbed train car, is the car going toward you or away, and how fast? |
| 9.2 m/s toward | 10. If a car 217 Hz car horn is heard at 223 Hz, is the car approaching you or receding from you, and what is its speed? |
| 17.5 m/s away | 11. You are riding in a train with a blindfold on, and you hear an 880 Hz crossing bell, but it appears to have a pitch of only 835 Hz. Are you moving toward or away from the bell, and how fast? |
| 27.3 m/s toward | 12. How fast and in what direction (away or toward) do you have to run relative to a concertmaster playing an A 440 Hz so that you hear it at 475 Hz? |
| 388.4 Hz | 13. You are driving at 27 m/s toward an oncoming driver on a highway. They are approaching you at 43 m/s. (a tad in excess of the speed limit) You honk at them with your 318 Hz horn to indicate your dissatisfaction with their driving habits. What frequency do they hear? |
| 453.4 Hz | 14. You are driving your Porsche at 57 m/s on the Autobahn and you come behind a Prius in the left lane going only 35 m/s. You honk your 421 Hz horn at them. What frequency do they hear? |
| 94,900.3 Hz | 15. A bat flying at 17 m/s is approaching a moth flying toward the bat at 7.0 m/s. If the bat generates an echolocation frequency of 82,500 Hz, what frequency does the bat hear reflected off the moth? |

B. Interference Problems: (Use **343 m/s** as the speed of sound.)

1. Two speakers 4.10 m apart are in phase at 512 Hz. If I am 4.00 m from one speaker, and 6.68 m from the other, what is the wavelength, and how many wavelengths difference is the distance, and is it constructive (loud) or destructive (quiet) interference? (λ= 0.670 m, 4 λ, Constructive)

2. Two speakers 4.50 m apart are in phase at 256. Hz. If I am 3.00 m from one speaker, and 6.35 m from the other, what is the wavelength, and how many wavelengths difference is the distance, and is it constructive (loud) or destructive (quiet) interference? (λ= 1.34 m, 2.5 λ, Destructive)

3. Two speakers 5.00 m apart are in phase at 1024. Hz. If I am 8.42 m from one speaker, and 9.59 m from the other, what is the wavelength, and how many wavelengths difference is the distance, and is it constructive (loud) or destructive (quiet) interference? (λ= 0.335 m, 3.5 λ, Destructive)

4. These two sources A and B are in phase, and generate a sound wave with a frequency of 625 Hz. Calculate the wavelength, and for the two positions p and q, indicate the path length difference in wavelengths, and whether it would be constructive or destructive interference.

(λ = 0.549 m, p: 1.5 λ Destructive, q: 1.0 λ Constructive)

 

5. These two sources A and B are in phase, and generate a sound wave with a frequency of 631 Hz. Calculate the wavelength, and for the two positions p and q, indicate the path length difference in wavelengths, and whether it would be constructive or destructive interference.

(λ = 0.544 m, p: 1.5 λ Destructive, q: 1.0 λ Constructive)

 

6. These two sources A and B are in phase, and generate a sound wave with a frequency of 2115 Hz. Calculate the wavelength, and for the two positions p and q, indicate the path length difference in wavelengths, and whether it would be constructive or destructive interference.

(λ = 0.162 m, p: 2.5 λ Destructive, q: 8.5 λ Destructive)

 