

18-8 The Doppler Effect

18-08

Question 161

A driver of a racing car hears a frequency of 1.0×10^4 Hz while moving with a speed of $0.25v$ (v is the speed of sound in air) towards a stationary source. Find the frequency of the source.

- (a) 0.8×10^4 Hz.
- (b) 0.9×10^4 Hz.
- (c) 1.2×10^4 Hz.
- (d) 1.0×10^4 Hz.
- (e) 0.7×10^4 Hz.

18-08

0.45-32%

Question 162

Which of the following statements is CORRECT?

- (a) For the Doppler effect, the observed frequency is always less than the actual frequency of the source.
- (b) The power of sound emitted is always inversely proportional to the distance from the source.
- (c) Sound waves are transverse.
- (d) For spherical sound waves, the displacement amplitude decreases linearly with increasing distance from the source.
- (e) The intensity of sound waves is independent of the distance from the source.

18-08

0.53-32%

Question 163

A stationary device generates sound waves of unknown frequency. An observer hears a frequency of 825 Hz as he approaches the device with a speed of 16 m/s. He hears a frequency of 750 Hz as he moves away from the device with the same speed. Find the speed of sound from the above information.

- (a) 331 m/s
- (b) 345 m/s
- (c) 336 m/s
- (d) 350 m/s
- (e) 340 m/s

18-08

Question 164

An ambulance siren emits a sound of frequency 1.60 kHz. A person running with a speed of 2.50 m/s hears a frequency of 1.70 kHz as the ambulance approaches him from the back. How fast is the ambulance moving? (speed of sound is 340 m/s).

- (a) 17.7 m/s
- (b) 22.4 m/s
- (c) 2.50 m/s
- (d) 12.2 m/s
- (e) 25.6 m/s

18-08

0.38-31%

Question 165

A train passes a train station at a constant speed of 40 m/s. The train whistle is sounded at a frequency of 320 Hz. An observer at the station hears a frequency f_1 while the train is approaching and a frequency f_2 while the train is moving away from the station. What change in frequency ($f_1 - f_2$) does the observer notice? ($v(\text{air}) = 343$ m/s.)

- (a) 62 Hz
- (b) 320 Hz
- (c) 40 Hz
- (d) 76 Hz
- (e) 25 Hz

18-08

Question 166

A train approaches a mountain at a speed of 75 km/hr. The train's engineer sounds a whistle that emits a frequency of 420 Hz. What will be the frequency of the echo that the engineer hears reflected off the mountain? (The speed of sound in air = 343 m/s).

- (a) 420 Hz
- (b) 400 Hz
- (c) 446 Hz
- (d) 430 Hz
- (e) 474 Hz

18-08

Question 167

An ambulance siren emits a sound of frequency 1.60 kHz. A person running with a speed of 2.50 m/s hears a frequency of 1.70 kHz as the ambulance approaches him from the back. How fast is the ambulance moving? (speed of sound is 340 m/s).

- (a) 25.6 m/s.
- (b) 2.50 m/s.
- (c) 17.7 m/s.
- (d) 22.4 m/s.
- (e) 12.2 m/s.

18-08

1.23-14%

Question 168

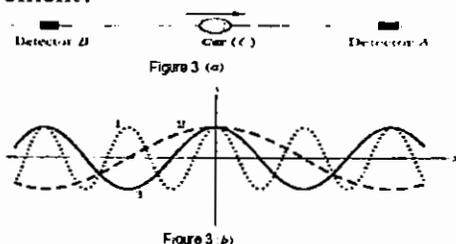
A police car is approaching a stationary observer at 34.0 m/s with its siren emitting a frequency of 450 Hz. What is the frequency heard by the observer? [Speed of sound in air = 343 m/s].

- (a) 525 Hz.
- (b) 475 Hz.
- (c) 485 Hz.
- (d) 500 Hz.
- (e) 405 Hz.

18-08

Question 169

A car emitting a sound wave at a certain frequency moves along an x-axis (figure 2 a). The car moves directly toward detector A and directly away from detector B. The superimposed three plots of figure 2 b indicate the displacement function $s(x)$ at some time t of the sound wave as measured by detector A, by detector B, and by someone in C. Which plot corresponds to which measurement?



- (a) 1 to A , 3 to B , 2 to C
- (b) 2 to A , 3 to B , 1 to C
- (c) 2 to A , 1 to B , 3 to C
- (d) 1 to A , 2 to B , 3 to C
- (e) 3 to A , 2 to B , 1 to C

Question 17018-08
0.50-26%

A police car moves at a speed of 50.00 m/s behind a truck that has a speed of 25.00 m/s as in figure 1. The police siren has a frequency of 1200 Hz. What is the frequency as heard by the truck driver ?



Figure 1

- (a) 975.0 Hz
- (b) 1408 Hz
- (c) 1200 Hz
- (d) 1302 Hz
- (e) 1125 Hz

Question 17118-08
0.25-80%

A stationary source emits a sound wave of frequency f . A man travels toward the source at half the speed of sound. The frequency as detected by the man is:

- (a) $3f$
- (b) $3f/2$
- (c) $2f/3$
- (d) f
- (e) $2f$

Question 17218-08
0.29-17%

Two trucks are moving toward each other. Truck A moves at a speed of 13.8 m/s and truck B moves at a speed of 22.2 m/s. Truck A sounds its horn with a frequency of 500 Hz. What will be the frequency heard by truck B ? [speed of sound in air = 343 m/s].

- (a) 451 Hz
- (b) 512 Hz
- (c) 532 Hz
- (d) 521 Hz
- (e) 555 Hz

Question 17318-08
0.30-17%

Consider a sound source S and a sound detector D. Which of the following situations may result in the detector observing the same frequency as that of the source ?

- (a) S is stationary and D moves away from S.
- (b) S moves toward D and D moves away from S with the same speed.
- (c) Both S and D move away from each other with the same speed.
- (d) D is stationary and S moves away from D.
- (e) S moves toward D and D moves toward S with the same speed.

Question 174

18-08

A bat is moving toward a wall with a velocity of 30 m/s. The bat is emitting a sound with frequency 40.0 kHz. The frequency of the reflected sound as heard by the bat is: [take the speed of sound in air = 340 m/s]

- (a) 43.9 kHz.
- (b) 33.5 kHz.
- (c) 43.5 kHz.
- (d) 47.7 kHz.
- (e) 40.0 kHz.

Question 175

18-08

0.22-14%

The whistle on a train generates a tone of 440 Hz as the train approaches a station at 30.0 m/s. Find the frequency that a stationary observer standing at the station will hear. (assume the speed of sound = 330 m/s.)

- (a) 472 Hz.
 - (b) 493 Hz.
 - (c) 440 Hz.
 - (d) 528 Hz.
 - (e) 484 Hz.
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Question 176

18-08

0.49-33%

A stationary observer hears a frequency of 760 Hz of a whistle of a train moving at a speed of 40 m/s towards him. If the train is moving away with the same speed, then the frequency detected by the observer will be: [Take the speed of sound in air = 340 m/s].

- (a) 600 Hz.
 - (b) 540 Hz.
 - (c) 700 Hz.
 - (d) 500 Hz.
 - (e) 963 Hz.
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Question 177

18-08

0.30-15%

Two cars are traveling in opposite directions toward each other with the same speed. One of the cars sounds the horn, which has a frequency of 544 Hz. The other car hears the frequency as 563 Hz. What is the speed of the cars? Use 344 m/s as the speed of sound in air.

- (a) 8.19 m/s
 - (b) 11.6 m/s
 - (c) 10.0 m/s
 - (d) 5.90 m/s
 - (e) 7.24 m/s
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Question 178

18-08

0.27-41%

An ambulance travels along a highway at a speed of 33.5 m/s. Its siren emits sound at a frequency of 1000 Hz. A car is traveling in the opposite direction at a speed of 24.5 m/s. What frequency is heard by a passenger in the car as the car moves away from the ambulance? (speed of sound in air = 343 m/s)

- (a) 1180 Hz
 - (b) 976 Hz
 - (c) 842 Hz
 - (d) 846 Hz
 - (e) 1187 Hz
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Question 179

18-08

0.32-22%

An ambulance emits sound with a frequency of 2600 Hz. After passing a motorist driving (in the same direction of the ambulance) with a speed of 5 m/s, the motorist receives the sound with frequency of 2424 Hz. Calculate the speed of the ambulance. [speed of sound in air is 340 m/s]

- (a) 50.0 m/s.
 - (b) 1.0 m/s.
 - (c) 15.0 m/s.
 - (d) 30.0 m/s.
 - (e) 5.0 m/s.
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18-08
0.27-12%**Question 180**

An ambulance emits sound of frequency 300 Hz and is moving with a speed of 45.0 m/s away from a moving car. If the car is moving towards the ambulance with a speed of 15.0 m/s, what frequency does a person in the car hear? [The speed of sound in air is 343 m/s].

- (a) 250 Hz.
 - (b) 277 Hz.
 - (c) 300 Hz.
 - (d) 333 Hz.
 - (e) 370 Hz.
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