Examples

1. What is the observed frequency of a 525 Hz source moving towards a stationary observer at 75 m/s? Take the speed of sound to be 375 m/s.

$f_{obs} = ?$

$f_{src} = 525\ Hz$

$v_{obs} = 0\ m/s$

$v_{src} = 75\ m/s$

$v_{sound} = 375\ m/s$

$$f_{obs} = f_{src}\left(\frac{v_{sound} + v_{obs}}{v_{sound} - v_{src}}\right)$$

$$f_{obs} = 525\left(\frac{375 + 0}{375 - 75}\right)$$

$$f_{obs} = 525\left(\frac{375}{300}\right)$$

$$= 525(1.25)$$

$$\boxed{f_{obs} = 656\ Hz}$$

2. A police siren has a frequency of 1.8×10^4 Hz. A crook in his getaway car drives away from the police at 105 m/s. What frequency is heard by the crook if the police car is driving at 85 m/s? The temperature today is 25 °C.

$f_{obs} = ?$

$f_{src} = 18000$ Hz

$v_{obs} = 105$ m/s

$v_{src} = 85$ m/s

v_{sound}

$v_{sound} = 331 + 0.59 T_{air}$

$v_s = 331 + 0.59(25)$

$= 331 + 14.75$

$= 345.75$ m/s

$$f_{obs} = f_{src}\left(\frac{v_s - v_{obs}}{v_s + v_{src}}\right)$$

$$f_{obs} = 18000\left(\frac{345.75 - 105}{345.75 + 85}\right)$$

$$= 18000\left(\frac{240.75}{430.75}\right)$$

$$= 18000\,(0.5589)$$

$$\boxed{f_{obs} = 10060 \text{ Hz}}$$

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