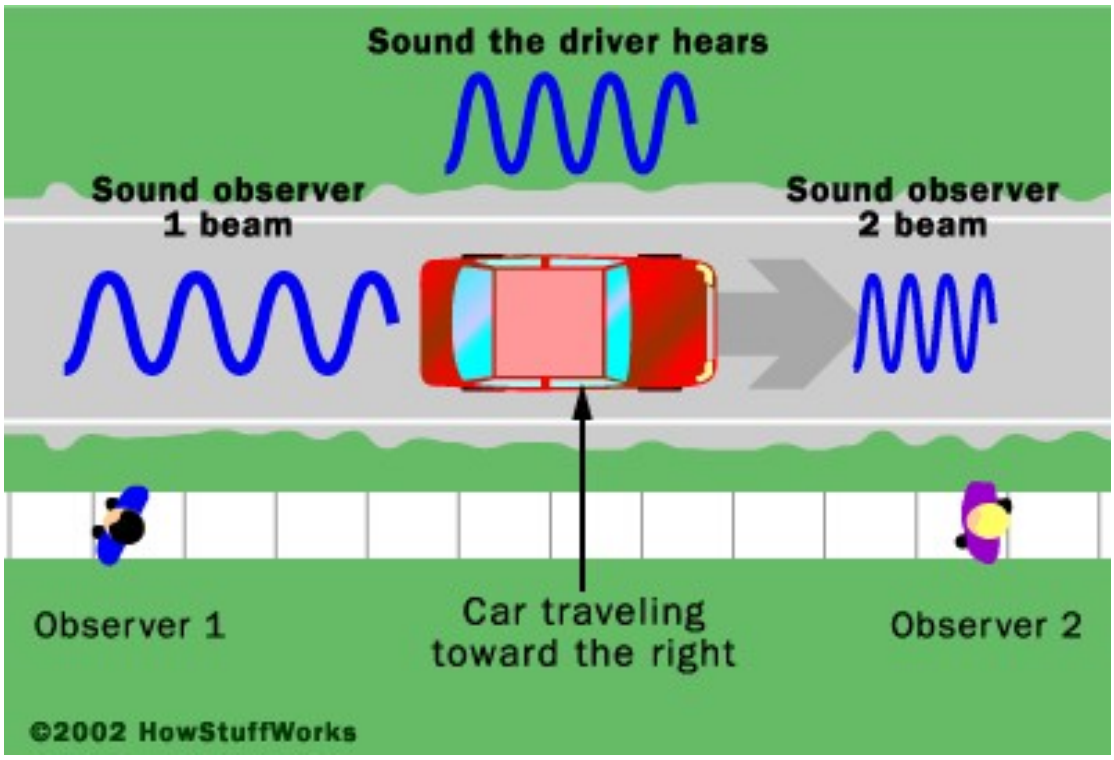

http://static.howstuffworks.com/gif/doppler.gif

- The relationship between the frequency of a moving source and an observer (in one dimension) is represented by the Doppler shift formula as two cases: The observer and source are approaching or receding.

Approaching: $f_o = f_s\left(\frac{v + v_o}{v - v_s}\right)$

Receding: $f_o = f_s\left(\frac{v - v_o}{v + v_s}\right)$

- f_o = observed (heard) frequency
- f_s = source frequency
- v_o = observer's velocity
- v_s = velocity of the source
- v = speed of sound in medium.
- We do not need to associate a sign notation with the moving objects; the formula takes that into account.

- The above are the general formulas for moving observers and sound sources. The formulas become much simpler of one object is moving and the other is not.

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.

$f_{obs} = ?$

$f_{src} = 525\ Hz$

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

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

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

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

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

$$f_{obs} = 525(1.25)$$

$$= 656\ Hz$$

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.

$f_{obs} = ?$

$f_{src} = 18000\ Hz$

$v_{obs} = 105\ m/s$

$v_{src} = 85\ m/s$

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

$= 346\ m/s$

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

$$= (18000)\left(\frac{346 - 105}{346 + 85}\right)$$

$$= 18000\left(\frac{241}{431}\right) = 18000(0.56)$$

$$\boxed{f_{obs} = 10000\ Hz}$$

Pg 23 #39-50 (except 45, 49)