Answer on Question #50202 – Physics – Other

a policeman on duty detects a drop of 10% in pitch of the horn of a moving car as it crosses him. If the velocity of sound is 330 m/s. calculate the speed of the car...

Solution:
When a car is approaching the stationary policeman with a velocity v_s, then the apparent frequency of the car

$$f' = f\left(\frac{v}{v - v_s}\right) \quad (1)$$

When the car has crossed the policeman it moves away the stationary policeman, hence, v_s is negative. If f'' is the new apparent frequency of the car,

$$f'' = f\left(\frac{v}{v + v_s}\right) \quad (2)$$

Dividing equation (1) by (2), we get

$$\frac{f'}{f''} = \frac{v + v_s}{v - v_s} \quad (3)$$

Now as the drop of pitch of the horn received by the policeman is 10%, that is

$$\frac{f'}{f''} = \frac{100}{90}$$

therefore from equation (3), we have

$$\frac{100}{90} = \frac{10}{9} = \frac{v + v_s}{v - v_s} = \frac{330 + v_s}{330 - v_s}$$

$$3300 - 10v_s = 2970 + 9v_s$$

$$330 = 19v_s$$

$$v_s = 17.3\ \frac{m}{s}$$

Answer: speed of the car is equal to $17.3\ \frac{m}{s}$