

# 20 11.15

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## QUESTION

A train, standing at the outer signal of a railway station blows a whistle of frequency 400 Hz in still air. (i) What is the frequency of the whistle for a platform observer when the train (a) approaches the platform with a speed of  $10\text{ms}^{-1}$ , (b) recedes from the platform with a speed of  $10\text{ms}^{-1}$ ? (ii) What is the speed of sound in each case ? The speed of sound in still air can be taken as  $340\text{ms}^{-1}$ .

(ii) The speed of sound in each will be same. It is  $340\text{ms}^{-1}$  in each case.

Solution :-

frequency of whistle,  $F = 400\text{Hz}$

speed of sound in air,  $a = 340\text{ms}^{-1}$

speed of train,  $u = 10\text{ms}^{-1}$

(i) a. When the train approaches the platform (i.e., the observer at rest),

$F'_a$  is frequency observed by observer when train is approaching platform ,

$$F'_a = F \times \frac{a}{a - u}$$

$$F'_a = 400 \times \frac{340}{340 - 10}$$

$$F'_a = 412.1212$$

b. When the train recedes the platform (i.e., the observer at rest),

$F'_a$  is frequency observed by observer when train is receding platform,

$$F'_r = F \times \frac{a}{a + u}$$

$$F'_r = 400 \times \frac{340}{340 + 10}$$

$$F'_r = 388.5714$$