PROBLEMS ON TRAINS

(a) If a train of length l meters passes a platform or bridge of length m metres, then distance travelled is Distance = l + m

(b) If a train of length l meters passes a pole, man, tree etc, then Distance travelled is Distance = l meters

(c) If two trains of lengths L_1& L_2 are travelling in the same direction with speeds S_1 & S_2 then. Time taken by faster train to cross slower train is given by $T=(L_1+L_2)/(S_1-S_2)$

(d) If two trains of length L_1 & L_2 are travelling is opposite direction with speeds S_1 & S_2, then time taken by trains to cross each other is $T=(L_1+L_2)/(S_1-S_2)$

(e) Two trains of length L_1 & L_2 run on parallel tracks. When running is same direction, the faster train passes slower train in T_1 secs, but when they are running in opposite direction with same speeds, they pass each other in T_2 sec. Then,

Speed of faster train= $\frac{L1+l2}{2}(\frac{1}{T1}+\frac{1}{T2})$

Speed of slower train= $\frac{L1+l2}{2}(\frac{1}{T1}-\frac{1}{T2})$

Example 1: A 420 m long train crosses a pole in 70 seconds. What is the speed of the train?

Solution:

To solve this question, we can apply a short trick approach we get

$$\text{Speed of train} = \frac{\text{Length of train}}{\text{Time taken in crossing the pole}}.$$

$$= \frac{420}{70} = 6 \text{ m/sec}$$

Example 2: A 240 m long train crosses a platform twice its length in 2 min. What is the speed of the train?

Solution:

"When a train passes a platform or crosses a bridge it should travel the length equal to the sum of the length of train and platform or bridge both"

$$\text{Speed of train} = \frac{\text{Length of train + Length of Platform}}{\text{Required time}}$$

Given,

Length of train = 240 m, crossing time of platform = 2 × 60 = 120 sec

Length of platform = 240 × 2 = 480, Speed of train = x

By the short trick approach, we get

Speed of train = $\frac{240 + 480}{120} \Rightarrow x = \frac{720}{120} = 6$ m/s.

Example 3: A train, 120 m long, takes 6 seconds to pass a telegraph post; the speed of the train is?

Solution:

Speed of train = $\frac{\text{Length of train}}{\text{Time taken in crossing the pole}}$.

$= \frac{120}{6} = 20$ m/sec

$= 20 \times \frac{18}{5} = 72$ kmph

Example 4: A train 150 m long passes a pole in 15 seconds and crosses another train of the same length travelling in the opposite direction in 8 seconds. The speed of the second train in (km/h) is

Solution:

Speed of the first train = $\frac{150}{15} = 10$ m/sec

Let the speed of the second train be x m/sec

Relative speed = (10 + x) m/sec

Length of train 1 + length of train 2 = 150 + 150 = 300 m

In the second scenario equation will be like $\frac{300}{10 + x} = 8$

or, 300 = 80 + 8x

or, x = $\frac{220}{8} = \frac{55}{2}$m/sec

$\therefore$ speed of the second train = $\frac{55}{2} \times \frac{18}{5}$ = 99 km/hr

Example 5. Two trains 165 m and 135 m long run at the speed of 70 km/hr and 38 km/hr respectively in opposite directions on parallel tracks. The time (in seconds) which they take to cross each other is:

Solution:

Relative speed = (70 + 38) = 108 km/hr {As the trains are moving in opposite directions)

$\Rightarrow$ $(108 \times \frac{5}{18})$ = 30 m/sec.

Distance covered in crossing each other = (165 + 135) = 300 m

Reqd. time = $(300 \times \frac{1}{30})$sec $\Rightarrow \frac{30}{3}$sec = 10 sec.