PROBLEMS ON TRAINS

1. **Conversions**

km/hr to m/s	**m/s to km/hr**
x km/hr = x * 5 m/s. 18	x m/s = x * 18 km/hr. 5

2. Time taken by a train of length l metres to pass a pole or standing man or a signal post is equal to the time taken by the train to cover l metres.

3. Time taken by a train of length x metres to pass a stationery object of length y metres is the time taken by the train to cover (x + y) metres.

4. Suppose 2 trains or objects bodies are moving in the same direction at v1 m/s and v2 m/s, where v1 > v2, then their relative speed is = (v1 – v2) m/s.

5. Suppose 2 trains or two objects bodies are moving in opposite directions at v1 m/s and v2 m/s, then their relative speed is = (v1 + v2) m/s.

6. If 2 trains of length x metres and y metres are moving in opposite directions at v1 m/s and v2 m/s, then: Time taken by the trains to cross each other = (x + y) / (v1 + v2) sec

7. If 2 trains of length x metres and y metres are moving in the same direction at v1 m/s and v2 m/s, then: Time taken by the faster train to cross the slower train = (x + y) / (v1 - v2) sec.

8. If two trains or bodies start at the same time from points A and B towards each other and after crossing they take a and b sec in reaching B and A respectively, then:
(A's speed): (B's speed) = (b: a)

Problems with solutions

1. A train running at the speed of 60 km/hr crosses a pole in 9 seconds. What is the length of the train?

Solution

$$\text{Speed} = \left(60 \times \frac{5}{18}\right)\text{m/sec} = \left(\frac{50}{3}\right)\text{m/sec.}$$

Length of the train = (Speed x Time).

$$\text{Length of the train} = \left(\frac{50}{3} \times 9\right)\text{m} = 150 \text{ m.}$$

2. A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is 54 km/hr, what is the length of the platform?

Solution

$$\text{Speed} = \left(54 \times \frac{5}{18}\right)\text{m/sec} = 15 \text{ m/sec.}$$

Length of the train = (15 x 20) m = 300 m.

Let platform length be x metres.
Then

$\frac{x + 300}{36} = 15$

$x + 300 = 540$

$x = 240$ m.

3. A train 800 metres long is running at a speed of 78 km/hr. If it crosses a tunnel in 1 minute, then the length of the tunnel (in meters) is:

Solution

Speed = $\left(78 \times \frac{5}{18}\right)$m/sec = $\left(\frac{65}{3}\right)$ m/sec.

Time = 1 minute = 60 seconds.

Let tunnel length x metres.

Then $\left(\frac{800 + x}{60}\right) = \frac{65}{3}$

$3(800 + x) = 3900$

$x = 500$.

4. A train 240 m long passes a pole in 24 seconds. How long will it take to pass a platform 650 m long?

Solution

Speed = $\left(\frac{240}{24}\right)$m/sec = 10 m/sec.

Time Required = $\left(\frac{240 + 650}{10}\right)$sec = 89 sec.

5. Two trains are running in opposite directions with the same speed. If the length of each train is 120 metres and they cross each other in 12 seconds, then the speed of each train (in km/hr) is:

Solution

Let each train speed be x m/sec, relative speed of the 2 trains = 2x m/sec.

Then $2x = \frac{(120 + 120)}{12}$

$2x = 20$

$x = 10$.

Therefore each train Speed = 10 m/sec = $\left(10 \times \frac{18}{5}\right)$ km/hr = 36 km/hr.