

## PROBLEMS ON TRAINS.

1. A 100m long train is running at the speed of 30 km/hr. Find the time taken by it to pass a man standing near the railway line.

Soln:

$$\text{Speed of the train} = \left[ 30 \times \frac{5}{18} \right] \text{ m/sec} = \left[ \frac{25}{3} \right] \text{ m/sec.}$$

Distance moved in passing the standing man = 100 m.

$$\text{Required time taken} = \frac{100}{\left(\frac{25}{3}\right)} = \left(100 \times \frac{3}{25}\right) \text{ sec} = 12 \text{ sec.}$$

2. A train is moving at a speed of 132 km/hr. If the length of the train is 110m, how long will it take to cross a railway platform 165m long?

Soln:

$$\text{Speed of train} = \left[ 132 \times \frac{5}{18} \right] \text{ m/sec} = \left[ \frac{110}{3} \right] \text{ m/sec}$$

$$\text{Distance covered in passing the platform} = (110 + 165) \text{ m} = 275 \text{ m.}$$

$$\therefore \text{Time taken} = \left[ 275 \times \frac{3}{110} \right] \text{ sec} = \frac{15}{2} \text{ sec.}$$

$$= 7 \frac{1}{2} \text{ sec.}$$

3. A 160m long train crosses a 160m long platform in 16 seconds. Find the speed of the train.

Soln:

Distance covered in passing the platform,  
 $= (160 + 160) \text{ m} = 320 \text{ m}.$

$\therefore$  Speed of train.

$$= \left( \frac{320}{16} \right) \text{ m/sec} = 20 \text{ m/sec}$$

$$= \left( 20 \times \frac{18}{5} \right) \text{ km/hr}$$
$$= 72 \text{ km/hr}.$$

4. A person standing on a railway platform noticed that a train took 21 seconds to completely pass through the platform which was 84 m long and it took 9 seconds in passing him. Find the speed of the train in km/hr.

Soln:

Let the length of the train be  $x$  metres.

then,

The train covers  $x$  metres in 9 seconds and  $(x + 84)$  metres in 21 seconds.

So, length of the train = 63 m.

$$\text{Speed of the train} = \left( \frac{63}{9} \right) \text{ m/sec} = 7 \text{ m/sec}$$

$$= \left( 7 \times \frac{18}{5} \right) \text{ km/hr}$$

$$= \left( \frac{126}{5} \right) \text{ km/hr}$$

$$= 25.2.$$

5. A train travelling with constant speed crosses a 90 m long platform in 12 seconds and a 120 m long platform in 15 seconds. Find the length of the train and its speed.

Soln!

Let the length of the train be  $x$  metres.

$$\text{then, } \frac{x+90}{12} = \frac{x+120}{15} \Leftrightarrow 15(x+90) = 12(x+120)$$

$$\Leftrightarrow 15x + 1350 = 12x + 1440$$

$$\Leftrightarrow 3x = 90 \Leftrightarrow x = 30$$

$$\text{Speed of the train} = \left( \frac{30+90}{12} \right) \text{ m/sec} = 10 \text{ m/sec}$$

$$= \left( 10 \times \frac{18}{5} \right) \text{ km/hr} = 36 \text{ km/hr.}$$

Hence length of train = 30m, Speed of train = 36 km/hr.

b. A 150 m long train is running with a speed of 68 kmph. In what time will it pass a man who is running at 8 kmph in the same direction in which the train is going.

Soln!

Speed of the train relative to man

$$= (68 - 8) \text{ kmph.}$$

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

$$= \left( \frac{50}{3} \right) \text{ m/sec.}$$

Time taken by the train to cross the man.

= Time taken by it to cover

$$150 \text{ m at } \left( \frac{50}{3} \right) \text{ m/sec.}$$

$$= \left( 150 \times \frac{3}{50} \right) \text{ sec.}$$

$$= 9 \text{ sec.}$$

7. A 220m long train is running with a speed of 59 kmph. In what time will it pass a man who is running at 7 kmph in the direction opposite to that in which the train is going.

Soln:

Speed of the train relative to man =  $(59+7)$  kmph.

$$= \left(66 \times \frac{5}{18}\right) \text{ m/sec} = \left(\frac{55}{3}\right) \text{ m/sec}$$

Time taken by the train to cross the man.

= Time taken by it to cover 220m at

$$\left(\frac{55}{3}\right) \text{ m/sec} = \left(220 \times \frac{3}{55}\right) \text{ sec.}$$

$$= 12 \text{ Sec.}$$

8). Two trains 240 metres and 270 metres in length are running towards each other on parallel lines, one at the rate of 60 kmph and another at 48 kmph. How much time will they take to cross each other.

Soln:

Relative speed of the two trains.

$$= (60 + 48) \text{ kmph.}$$

$$= 108 \text{ kmph}$$

$$= \left(108 \times \frac{5}{18}\right) \text{ m/sec.}$$

$$= 30 \text{ m/sec.}$$

Time taken by the trains to pass each other.

= Time taken to cover  $(240+270)$ m at

$$30 \text{ m/sec} = \left(\frac{510}{3}\right) \text{ sec}$$

$$= 17 \text{ Sec.}$$

9. A 300m long train passed a man walking along the line in the same direction at the rate of 3 km/hr in 33 seconds. Find the speed of the train in km/hr.

Soln:

Speed of the train relative to man

$$= \left( \frac{300}{33} \right) \text{m/s}$$

$$= \left( \frac{100}{11} \right) \text{m/s}$$

$$= \left( \frac{100}{11} \times \frac{18}{5} \right) \text{km/hr}$$

$$= \left( \frac{360}{11} \right) \text{km/hr}$$

Let the speed of the train be  $x$  km/hr,  
Then, relative speed =  $(x-3)$  km/hr.

$$\therefore x-3 = \frac{360}{11} \Rightarrow \frac{360}{11} + 3 = \frac{393}{11}$$

$$= 35 \frac{8}{11}$$

Hence, speed of train =  $35 \frac{8}{11}$  km/hr.

10. Two trains 100 metres and 120 metres long are running in the same direction with speed of 72 km/hr and 54 km/hr. In how much time will the first train cross the second?

Soln:

Relative speed of the train

$$= (72-54) \text{km/hr}$$

$$= 18 \text{km/hr}$$

$$= \left( 18 \times \frac{5}{18} \right) \text{m/Sec} = 5 \text{m/Sec.}$$

Time taken by the trains to pass each other.

$$= \text{Time taken to cover } (100 + 120) \text{ m at } 5 \text{ m/sec} = \left( \frac{220}{5} \right) \text{ sec.} \\ = 44 \text{ Sec.}$$

11. A 100 m long train, takes  $4\frac{1}{5}$  seconds to cross a man walking at the rate of 5 km/hr in the direction opposite to that of the train. what is the speed of the train?

Soln:

Let the speed of the train be  $x$  km/hr.  
Speed of the train relative to man  
 $= (x + 5) \text{ km/hr}$   
 $= \left[ (x + 5) \times \frac{5}{18} \right]$

$$\frac{100}{(x + 5) \times \frac{5}{18}} = \frac{36}{5} \Leftrightarrow 10x + 50 = 500$$

$$\Leftrightarrow 10x = 450 \Leftrightarrow x = 45$$

Hence, speed of the train = 45 km/hr.

12. A train 100m long travelling at 60 km/hr passes another train twice as fast as this train and travelling in opposite direction, in 10 seconds. Find the length of the second train.

Soln:

$$\text{Relative Speed} = (60 + 120) \text{ km/hr}$$

$$= (180 \times \frac{5}{18}) \text{ m/sec} = 50 \text{ m/sec.}$$

Let the length of the second train be  $x$  metres.

$$\text{Then, } \frac{x+100}{10} = 50 \Rightarrow x+100 = 500$$

$$= x = 400.$$

13. A train running at 54 kmph, 20 seconds to pass a platform. Next it takes 12 seconds to pass a man walking at 6 kmph in the same direction in which the train is going. Find the length of the train and the length of the platform.

Soln:

Let the length of train be  $x$  metres and the length of platform by  $y$  metres.

Speed of the train relative to man

$$= (54 - 6) \text{ kmph} = 48 \text{ kmph.}$$

$$= \left[ 48 \times \frac{5}{18} \right] \text{ m/sec}$$

$$= \frac{40}{3} \text{ m/sec.}$$

In passing a man, the train covers its own length with relative speed.

$$\therefore \text{Length of train} = (\text{Relative Speed} \times \text{Time}).$$

$$= \left( \frac{40}{3} \times 12 \right) \text{m}$$

$$= 160 \text{m}.$$

$$\text{Also, Speed of the train} = \left( 54 \times \frac{5}{18} \right) \text{m/sec}.$$

$$= 15 \text{m/sec}.$$

$$\therefore \frac{x+y}{15} = 20 \Leftrightarrow x+y = 300$$

$$\Leftrightarrow y = (300 - 160) \text{m}$$

$$= 140 \text{m}.$$

14. A moving train, 66 metres long, overtakes another train 88 metres long, moving in the same direction, in 0.168 minutes. If the second train is moving at 30 km per hour, at what speed is the first train moving?

Soln:

Let the speed of the first train be  $x$  km/hr.

Then, Sum of lengths of trains

$$= (66 + 88) \text{m} = 154 \text{m}.$$

Relative speed of two trains

$$= (x - 30) \text{kmph}$$

$$= \left[ (x - 30) \times \frac{5}{18} \right] \text{m/sec}.$$



$$\therefore \frac{154}{(x-30) \times \frac{5}{18}} = 0.168 \times 60$$

$$\Leftrightarrow 5(x-30) = \frac{154 \times 18}{10.08} = 275$$

$$\Leftrightarrow x-30 = 55 \Leftrightarrow x = 85.$$

Hence speed of the first train = 85 km/hr.

15. A man sitting in a train which is travelling at 50 kmph observes that a goods train, travelling in opposite direction, takes 9 seconds to pass him. If the goods train is 280 m long, find its speed.

Soln:

$$\begin{aligned} \text{Relative speed} &= \left(\frac{280}{9}\right) \text{ m/sec} \\ &= \left(\frac{280}{9} \times \frac{18}{5}\right) \text{ kmph} \\ &= 112 \text{ kmph.} \end{aligned}$$

$$\begin{aligned} \therefore \text{Speed of goods train} &= (112 - 50) \text{ kmph} \\ &= 62 \text{ kmph.} \end{aligned}$$