

SPEED, TIME & DISTANCE

Problems on Trains :

Train "A" → Length = L_1 , Speed = X



Train "B" → Length = L_2 , Speed = Y

❖ If Train 'A' is moving faster and parallel to train 'B' then

- Relative speed is $(S_r) = (X - Y)$
- Time taken by two trains to cross each other is

$$\text{Time} = \frac{L_1 + L_2}{X - Y}$$

❖ If Train 'A' is moving opposite to train 'B' then

- Relative speed is $(S_r) = (X + Y)$
- Time taken by two trains to cross each other is

$$\text{Time} = \frac{L_1 + L_2}{X + Y}$$

- A train without stoppage travels with an average speed of X km/h, and with stoppage, it travels with an average speed of Y km/h. For how many minutes does the train stop on an average per hour is

$$\text{Stoppage per hour} = \frac{\text{Difference in Avg.Speed}}{\text{Speed without Stoppage}} \times 60 \text{ min}$$

Speed without Stoppage

- 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 seconds in reaching B and A respectively, then (A's speed): (B's speed) = $\sqrt{b} : \sqrt{a}$

- 1) A 210 metre long train takes 6 seconds to cross a man running at 9 km/hr in a direction opposite to that of the train. What is the speed of the train? (in km/hr)

Ans: 117 kmph

i.) $\text{Speed} = \frac{\text{distance}}{\text{Time}} \Rightarrow \text{Time} = \frac{\text{distance}}{\text{Speed}}$

$$T = \frac{d}{S} \Rightarrow 6 = \frac{210}{(x+9) \times \frac{5}{18}}$$

$$6 = \frac{42}{(x+9) \times \frac{5}{18}}$$

$$x+9 = 126 \Rightarrow x = 117 \text{ km/hr}$$

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

Ans: Time = 12sec

2.) $T = \frac{D}{S} \Rightarrow T = \frac{100}{30 \times \frac{5}{18}}$

$$T = \frac{100 \times 18}{30 \times 5}$$

$$T = 12 \text{ sec}$$

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

Ans: Time = 7.5 sec

3.) $T = \frac{D}{S} \Rightarrow T = \frac{275}{132 \times \frac{5}{18}} \Rightarrow \frac{275 \times 18}{132 \times 5}$

$$T = \frac{15}{2} = 7.5 \text{ sec}$$

4) Two trains of length 110 m and 90 m are running on parallel lines in the same direction with a speed of 50 km/hr and 45 km/hr respectively. In what time will they pass each other ?

Ans: Time = 144 sec

4.) $T = \frac{D}{S} \Rightarrow T = \frac{110 + 90}{(50 - 45) \times \frac{5}{18}} = \frac{200 \times 18}{5 \times 5}$

$$T = 144 \text{ sec}$$

5) A 180-metre long train crosses another 270-metre long train running in the opposite direction in 10.8 seconds. If the speed of the first train is 60 kmph, what is the speed of the

second train in kmph ?

Ans: 90 kmph

6.) $T = \frac{d}{s}$ [1 minute = 60 sec]

$$60 = \frac{[800 + x]}{78 \times \frac{5}{18}}$$

$$\frac{20}{60} = \frac{[800 + x] \times 8 \cancel{5}}{78 \times 5}$$

$$20 \times 13 \times 5 = 800 + x$$

$$1300 - 800 = x$$

Ans: $x = 500$ meters.

- 6) 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:

Ans: 500 meters

- 7) A train without stoppage travels with an average speed of

50 km/h, and with stoppage, it travels with an average speed of 40 km/h. For how many minutes does the train stop on an hour ?

Ans: 12 minutes

Stoppage per hour = $\frac{50 - 40}{50} \times 60 \text{ min}$

$$= \frac{10}{50} \times 60 \text{ min}$$

Stoppage per hour = 12 minutes.

8) A man sitting in a train which is traveling at 50 kmph observes that a goods train, traveling in opposite direction, takes 9 seconds to pass him. If the goods train is 280 m long, then the speed of goods train is



goods train taken 'q' seconds to pass him:

$$T = \frac{\text{distance}}{\text{speed}}$$
$$9 = \frac{280}{(x+50) \times \frac{5}{18}}$$
$$9 = \frac{280 \times 18}{(x+50) \times 5}$$
$$x+50 = 112$$
$$x = 62 \text{ kmph}$$