

# Trains



**While studying the chapter “Trains”, we are required to deal with following scenarios**

1. Two trains moving in opposite direction.
2. Two trains moving in same direction.
3. A train crossing a stationary object of a given length like a platform or bridge.
4. A train crossing a stationary object like a pole or a man which can be considered as a point object.

Keep same units for all values mentioned in the problem i.e. as per the units of the given answers convert kilometre per hour (km/hr) to meters per second (m/s) and vice versa. In a similar way, convert meter (m) into centimetre (cm) and vice versa. See the examples given below:

### Formula to convert Km/hr into m/s:

- 1km is equal to 1000 meters
- 1 hours is equal to 3600 seconds
- 1Km/hr is equal to  $\frac{1000 \text{ meters}}{3600 \text{ Sec}}$  or  $\frac{5}{18}$  meter/sec or m/s

So, to convert a value in Km/hr to m/s, we need to multiply it with  $\frac{5}{18}$

### Formula to convert m/s to Km/hr

- 1 meter is equal to 1/1000 km
- 1 sec is equal to 1/3600 hours
- 1 m/s is equal to  $\frac{1/1000}{1/3600}$  km/hr or  $\frac{3600}{1000} = \frac{18}{5}$  km/hr

So, to covert a value in m/s to Km/hr, we will multiply it with 18/5.

## Points to remember

**1**

### **RELATIVE SPEED OF TRAINS MOVING IN SAME DIRECTION**

When two trains are going in the same direction, then their relative speed is the difference between the speed of two trains

**2**

### **RELATIVE SPEED OF TRAINS IN OPPOSITE DIRECTION**

When two trains are moving in the opposite direction, their relative speed is the sum of the speed of the two trains

**3**

### **DISTANCE COVERED WHEN TWO TRAINS ARE MOVING IN THE SAME/OPPOSITE DIRECTION**

When two trains are moving in either the same or in different directions, the distance travelled will be the sum of length of both the trains

**4**

### **DISTANCE TRAVELLED WHEN A TRAIN CROSSES A STATIONARY OBJECT**

When a train crosses a stationary object or man, the distance travelled by the train is equal to the length of the train

**5**

### **DISTANCE TRAVELLED WHEN A TRAIN CROSSES A PLATFORM/BRIDGE**

When a train crosses a platform or a bridge, the total distance covered is the sum of the length of the train and the length of the bridge/platform

## Formulas

- **Speed of the Train = Total distance covered by the train / Time taken**
- If the length of two trains is given, say  $a$  and  $b$ , and the trains are moving in **opposite directions** with speeds of  $x$  and  $y$  respectively, then the **time taken by trains to cross each other** =  $(a + b) / (x + y)$

- If the length of two trains is given, say  $a$  and  $b$ , and they are moving in the **same direction**, with speeds  $x$  and  $y$  respectively, then the

**time is taken to cross each other =  $(a + b) / (x - y)$**

- When the **starting time of two trains is the same from  $x$  and  $y$  towards each other** and after crossing each other, they took  $t_1$  and  $t_2$  time in reaching  $y$  and  $x$  respectively, then the **ratio between the speed of two trains =  $\sqrt{t_2} : \sqrt{t_1}$**
- If two trains leave  $x$  and  $y$  stations at time  $t_1$  and  $t_2$  respectively and travel with speed  $L$  and  $M$  respectively, then distance from  $x$ , where two trains meet is =  **$(t_2 - t_1) \times \{(\text{product of speed}) / (\text{difference in speed})\}$**
- The average speed of a train without any stoppage is  $x$ , and with the stoppage, it covers the same distance at an average speed of  $y$ , then

**Rest Time per hour =  $(\text{Difference in average speed}) / (\text{Speed without stoppage})$**

- If two trains of equal lengths and different speeds take  $t_1$  and  $t_2$  time to cross a pole, then the

**time taken by them to cross each other if the train is moving in opposite direction =  $(2 \times t_1 \times t_2) / (t_2 + t_1)$**

- If two trains of equal lengths and different speeds take  $t_1$  and  $t_2$  time to cross a pole, then the

**time taken by them to cross each other if the train is moving in the same direction =  $(2 \times t_1 \times t_2) / (t_2 - t_1)$**