IMPORTANT FORMULA AND EQUATIONS

1. Speed, Time and Distance:

Speed = Distance / time

Time = distance /speed

Distance =speed*distance

2. km/hr to m/sec conversion:

x km/hr =[x*5/18] m/sec

3. m/sec to km/hr conversion:

x m/sec =[x* 18/5] km/h

4. If the ratio of the speeds of A and B is $a : b$, then the ratio of the

the times taken by then to cover the same distance is 1/a:1/b or b : a

5. Suppose a man covers a certain distance at x km/hr and an equal distance at y km/hr. Then, the average speed during the whole journey is [xy/(x+y)] km/hr

- Average speed: if both the time taken are equal i.e t1 = t2 = t ,then, t1 + t2 / 2
- The average of odd numbers from 1 to n is = [Last odd no. + 1] / 2.
- The average of even numbers from 1 to n is = [Last even no. + 2] / 2.
- (x + y) t km apart of they more in opposite direction.

KEY NOTE:

Caution average speed should not be calculated as average of different speeds, i.e., Ave. speed ≠

=Sum of speed / No. of different Speed

There are two different cases when average speed is required.

Case I

When time remains constant and speed varies :

If a man travels at the rate of x km/h for t hours and again at the rate of y km/h for another t hours, then for the whole journey, his average speed is given by

$$= \frac{\text{Total distance}}{\text{Total time taken}} = \frac{xt+yt}{t+t} = \frac{x+y}{2} kmph.$$

Average speed

Case II

When the distance covered remains same and the speeds vary :

When a man covers a certain distance with a speed of *x* km/h and another equal distance at the rate of *y* km/h. then for the whole journey, the average speed is given by Average speed =2xy/(x+y)km/h.

Velocity

The speed of a moving body is called as its velocity if the direction of motion is also taken into consideration

$$\text{Velocity} = \frac{\text{Net displacement of the body}}{\text{Time taken}}$$

Relative speed

a) Bodies moving in same direction

- When two bodies move in the same direction, then the difference of their speeds is called the relative speed of one with respect to the other.
- When two bodies move in the same direction, the distance between them increases (or decreases) at the rate of difference of their speeds.

b) Bodies moving in opposite direction

- The distance between two bodies moving towards each other will get reduced at the rate of their relative speed (i.e., sum of their speeds). The

=Initial distance between two bodies/ Some of their Speed

- Relative speed of one body with respect to other body is sum of their speeds.
- Increase or decrease in distance between them is the product of their relative speed and time.

Key notes to solve problems

- When a moving body covers a certain distance at *x* km/h and another same distance at the speed of *y* km/h, then average speed of moving body during its entire journey will be [2xy/(x+y)]km/h
- A man covers a certain distance at *x* km/h by car and the same distance at *y* km/h by bicycle. If the time taken by him for the whole journey by *t* hours, then Total distance covered by him $= \frac{2txy}{x+y}$ km.

- A boy walks from his house at x km/h and reaches the school ' t 1 ' minutes late. If he walks at y km/h he reaches ' t 2 ' minutes earlier. Then, distance between the school and the house. $= \frac{xy}{(y-x)}\left(\frac{t_1+t_2}{60}\right)$ km
- If a man walks with (x/y) of his usual speed he takes t hours more to cover a certain distance.
- Then the time to cover the same distance when he walks with his usual speed, $\frac{xt}{y-x}$ hours.
- If two persons A and B start at the same time in opposite directions from the points and after passing each other they complete thejourneys in ' x ' and ' y' hrs. respectively, then A's speed : B's speed $= \sqrt{y} : \sqrt{x}$.
- If the speed is (a/b) of the original speed, then the change in time taken to cover the same distance is given by Change in time = $\left(\frac{b}{a}-1\right)\times$ original time

Key notes to solve problems on Trains

- The time taken by a train in passing a signal post or a telegraph pole or a man standing near a railway line $= \frac{\text{Length of the train}}{\text{Speed of the train}}$
- The time taken by a train passing a railway bridge or a platform or a tunnel or a train at rest $= \frac{x+y}{\text{Speed}}$ where, x = length of the train y = length of the bridge or platform or standing train or tunnel
- Time taken by faster train to pass the slower train in the same direction $= \frac{x+y}{u-v}$
  where, x = length of the first train
  y = length of the second train
  u = speed of the first train
  v = speed of the second train and $u > v$
  Time taken by the trains in passing each other while moving in opposite direction $= \frac{x+y}{u+v}$

- Time taken by the train to cross a man $= \frac{x}{u-v}$ where, both are moving in the same direction and
  x = length of the train
  u = speed of the train and
  v = speed of the man.

  Time taken by the train to across a man running in the opposite direction $= \frac{x}{u+v}$

- If two trains start at the same time from two points A and B towards each other and after crossing, they take a and b hours in reaching B and A respectively. Then.
  $\text{A's speed : B's speed } = \left(\sqrt{b} : \sqrt{a}\right)$

- A train starts from a place at u km/h and another fast train starts from the same place after t hours at v km/h in the same direction. Find at what distance from the starting place both the trains will meet and also find the time of their meeting.
  $\text{Distance} = \frac{uvt}{v-u}\text{km}$

  $\text{time} = \frac{ut}{v-u}\text{hours}$

- The distance between two places A and B is x km. A train starts from A to B at u km/h. One another train after t hours starts from B to A at v km/h. At what distance from A will both the train meet and also find the time of their meeting
  $\text{Time} = \frac{x-ut}{u+v} + t\text{ hours}$
  $\text{Distance from A} = u\left(\frac{x-ut}{u+v} + t\right)\text{km.}$

- Two trains starts simultaneously from the stations A and B towards each other at the rates of u and v km/h respectively. When they meet it is found that the second train had traveled x km more than the first. Then the distance between the two stations $is \frac{x(u+v)}{v-u}\text{km.}$
  (i.e., between A and B)