Knowledge Card

Aptitude|Speed, Time, and Distance

Cantilever Labs

Speed, Distance and Time:

- **Speed = Distance/Time –** This tells us how slow or fast an object moves. It describes the distance travelled divided by the time taken to cover the distance.

  Speed is directly Proportional to Distance and Inversely proportional to Time. Hence,

- **Distance = Speed X Time**, and

- **Time = Distance / Speed**, as the speed increases the time taken will decrease and vice versa.

Speed, Time & Distance Conversions

- To convert from km / hour to m / sec, we multiply by 5 / 18. So, 1 km / hour = 5 / 18 m / sec

- To convert from m / sec to km / hour, we multiply by 18 / 5. So, 1 m / sec = 18 / 5 km / hour = 3.6 km / hour

- Similarly, 1 km/hr = 5/8 miles/hour

- 1 yard = 3 feet

- 1 kilometer= 1000 meters = 0.6214 mile

- 1 mile= 1.609 kilometer

- 1 hour= 60 minutes= 60*60 seconds= 3600 seconds

- 1 mile = 1760 yards

- 1 yard = 3 feet

- 1 mile = 5280 feet

- 1 mph = (1 x 1760) / (1 x 3600) = 22/45 yards/sec

- 1 mph = (1 x 5280) / (1 x 3600) = 22/15 ft/sec

- For a certain distance, if the ratio of speeds is a : b, then the ratio of times taken to cover the distance would be b : a and vice versa.

Formulas of Speed, Time and Distance

Distance = Speed x Time

Speed = $\left(\dfrac{Distance}{Time}\right)$

Time = $\left(\dfrac{Distance}{Speed}\right)$

Formula for Conversion of Km/hr to m/sec where x is in Km/hr

1 km = 1000m

1 h = 3600 s

So 1km /h = $\dfrac{1000}{3600}$

= $\dfrac{5}{18}$

Y $m/sec = \left(X\ x\dfrac{5}{18}\right)m/sec$

Formula for Conversion of m/sec to Km/hr where x is in m/sec

1 m = $\dfrac{1}{1000}$ km;

1 sec = $\dfrac{1}{3600}$ hr

1m/sec = $\dfrac{3600}{1000}$

= $\dfrac{18}{5}$

Y $km/hr = \left(X\ x\dfrac{18}{5}\right)km/hr$

Equal Distance at two speeds

An object covers equal distance at speed S1 and other equal distance at speed

S2 then his average speed for the distance is (2S1S2)/(S1 + S2)

Train based Formulas of Speed, Time and Distance-

- S_T = Speed of Train
- S_O= Speed of Object
- L_T= Length of Train
- L_O = Length of Object

Case 1 –

When Train Crosses a Stationary Object with no Length(e.g. Pole) in time t

- $S_T = \frac{L_T}{t}$

Case 2 –

When Train Crosses a Stationary Object with Length L_O (e.g. Train Platform) in time t

- $S_T = (L_T + L_O) / t$

Case 3 –

When Train Crosses a Moving Object with no Length (e.g. Car has negligible length) in time t

- **Objects moving in Opposite directions**
  - $(S_T + S_O) = L_T / t$
- **Objects moving in Same directions**
  - $(S_T - S_O) = L_T / t$

Case 4 –

When Train Crosses a Moving Object with Length L_O (e.g. Another Train treated as an object) in time t

- **Objects(Trains) moving in Opposite directions**
  - $(S_T + S_O) = (L_T + L_O) / t$
- **Objects(Trains) moving in Same directions**
  - $(S_T - S_O) = (L_T + L_O) / t$

Tips and tricks for speed, time and distance

When Distance is constant in the given scenario

Way to Solve type 0 Problem

We all know that Distance = Speed x Time

So, if Distance if constant then this equation will be

$S_1 \times T_1 = S_2 \times T_2$

Now, most of you will ignore this in the exam and it wouldn't cross your mind to use this. Even if you understand it now.

But, if you make a habit of reading question properly not just for speed time and distance but for every topic you can solve the question in 1/4th of the time.

Same of this, we had done research on 8 engineering students solving a speed time distance problem only 2 used this formula and both solved the question correctly in 1/4th of the time of other 6 on average.

Example of type 0 Problem

A boy walking at a speed of 15 km/hr reaches his school 20 min late. Next time he increases his speed by 5 km/h but still he late by 5 min. Find the distance of the school from his home.

Let time be x.

So, quick method =>

- $15(x +20) = 20(x + 5)$
- $300 - 100 = 5x$
- $x = 40. => x +20 = 60$ mins = 1hr
- Thus distance = 15(1) = 15 kms

explanation to above

$S_1 = 15$km/h ; $S_2 = 5 + 15 = 20$ km/h

$T_1 = x + 20$ $T_2 = x + 5$

Now just apply the formula

Now Same thing can be applied for Speed and Time also

So, the all three formulas will be –

1. $S_1 \times T_1 = S_2 \times T_2$

2. $D_1 / T_1 = D_2 / T_2$
3. $D_1 / S_1 = D_2 / S_2$

Type 1: Speed, Time and Distance Tips and Tricks Unit Conversion Time and Distance Problems

Ques 1.

A man rides his Bike at a speed of 36 km per hour, calculate the speed in m per second?

A. 7.0

B. 5.5

C. 10

D. 5

Correct Answer C
Solution: We can convert km per hour by multiplying the given value by 5/ 18.
Therefore, the converted speed = 36 * 5/18
= 10 m per second.

Type 2: Tips and Tricks and Shortcuts for (Average Speed when Traveling to a Place and Returning)

Ques 2.

G and H are two places. A man travels on his cycle from G to H at a speed of 15km/hr and comes back at the speed of 10km/hr. Find the average speed of his entire journey.

A. 11 km/hr

B. 12km/hr

C. 13km/hr

D. 13.5km/hr

Correct Answer B
Solution:

Let the distance between G and H be a

Then, time taken from G to H = a/15

Then, time taken from H to G = a/10

Therefore, time taken to cover 2a = a/15+a/10 = a/6

Therefore, average speed = 2a/a/6 = 12 km/hr.

Type 3: Shortcuts, Tips and Tricks for Prob's Based on Changing Time and Changing Speed

Ques 3.

If Karishma walks a certain distance, at the speed of 8mps, if she walks at a speed of 18mps, she covers 15 miles more. Calculate her total distance.

A. 6

B. 12

C. 17

D. 29

Correct Answer B
Solution:

Let her total distance be= d

Time to cover at the speed of 8 mps.

If she walks 18mph, then she covers 15 miles more than actual distance = d + 15

Therefore, time taken = (d+15)/18.

Then, d/8 = d + 15/18

So, distance covered is 12 m

Type 4: Time and Speed Problems on Trains

Ques 4.

A train 200m long is moving at a speed of 20 km/hr. How much time will the train take to reach the station?

A. 22

B. 28

C. 36

D. 25

Correct answer C
Solution:

Speed of the train = 20 * 5/18 = 50/9 m/sec

Requisite time = 200 * 9 / 50 = 36 seconds.

Type 5: Problems on Bus with Stoppages

Ques 5.

The speed of a bus excluding stoppage is 25 km per and including stoppages is 21 km per hour. Find out for how much time the bus stopped per hour.

A. 11.2

B. 9.6

C. 10

D. 25

Correct Answer B
Solution:

The bus travels 4 km less because of the stops.
Time is taken to cover 4 km = 4/25 * 60 = 9.6
The bus stopped for 9.6 minutes