Basics

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$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}} \qquad S \propto d$$

$$\text{Distance} = \text{Speed} \times \text{Time} \qquad d \propto t$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} \qquad S \propto \frac{1}{t} \text{ or } t \propto \frac{1}{S}$$

1. km/hr to m/sec conversion:

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

2. m/sec to km/hr conversion

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

Ex — A plane is moving with the speed of 180 km/hr. what is the speed in metre/sec.

$$180 \times \frac{5}{18} = 50 \text{ m/s}$$

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Ex In covering a certain distance the speed of A and B are in ratio 3:4. A takes 30 minutes more than B to reach the destination. The time taken by A to reach the destination is _____.

→ distance is D

Speed of A = 3x km/hr

" B = 4x km/hr

$$\frac{D}{3x} - \frac{D}{4x} = 30 = \frac{1}{2} \Rightarrow \frac{D}{12x} = \frac{1}{2} \therefore D = 6 //$$

time taken by A $= \frac{D}{3x} = \frac{6}{3} = 2$ hours //

GS

speed ratio = 3 : 4

time ratio = 4 : 3

1 = 30 min

4 = 120 min = 2 hours //

Ex // If a person walks at 14 km/hr instead of 10 km/hr, he would walked 20 km more. The actual distance = (?)

→ Actual distance travelled is D km.

$$\frac{D}{10} = \frac{D+20}{14} \Rightarrow 14D = 10D + 200$$

$$\Rightarrow 4D = 200 \Rightarrow D = 50 \text{ km} //$$

GR //

$$(14 - 10) = \frac{20}{T}$$

$$T = \frac{20}{4} = 5 \text{ hrs} //$$

$$D = T \times S = 5 \times 10 = 50 \text{ km} //$$

=) Average Speed

$$\text{Average speed} = \frac{\text{Total Distance}}{\text{Total Time taken}}$$

(i) If a car covers a distance d_1 km at s_1 km/hr and then d_2 km at s_2 km/hr then the average speed during whole journey is

$$\text{Average Speed} = \frac{s_1 s_2 (d_1 + d_2)}{s_1 d_2 + s_2 d_1}$$

(ii) A person goes certain distance (A to B) at speed of s_1 and returns (B to A) at speed of s_2 km/hr. If he takes T hrs in all,

$$\text{Average Speed} = \frac{2 s_1 \times s_2}{} \quad //$$

Average speed $= \frac{2 S_1 \times S_2}{S_1 + S_2}$ //

Distance between A & B $= \frac{t \cdot 2 S_1 \times S_2}{S_1 + S_2}$

(iii) If a person travelled three equal distance by three different speed S_1, S_2 & S_3

Average speed $= \frac{3 S_1 \times S_2 \times S_3}{S_1 S_2 + S_2 S_3 + S_3 S_1}$

Ex/ A man goes from place A to B at a speed of 12 km/hr & returns at 18 km/hr. Find average speed ?

$A.S = \frac{2 S_1 \times S_2}{S_1 + S_2} = \frac{2 \times 12 \times 18}{12 + 18} = 14.2 \frac{\text{km}}{5}$ hrs

Ex/ one-third of a certain journey is covered

Ex: one-third of a certain journey is covered at the rate of 25 km/hr. one-fourth at rate of 30 km/hr and the rest at 50 km/hr find the average speed.

$1 - \frac{1}{3} - \frac{1}{4}$

→ Total distance D

$\frac{S}{T}$

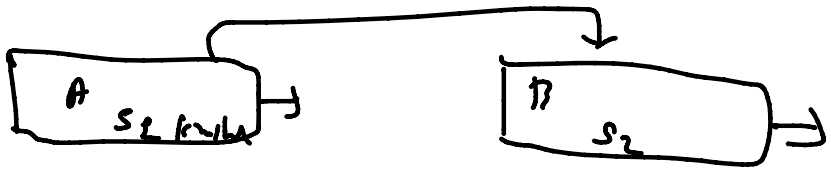
$$\text{Total Time} = \frac{D}{3\times 25} + \frac{D}{4\times 30} + \frac{5D}{12\times 50}$$

$$= \frac{8D+5D+5D}{600} = \frac{18D}{60D} = \frac{3D}{100}$$

$$\text{Average speed} = \frac{D}{T} = \frac{D}{\frac{3D}{100}} = \frac{100}{3} = 33\frac{1}{3} \text{ km/hr}$$

2) Relative Speed :-

1. If two objects are travelling in the same direction at s_1 km/hr and s_2 km/hr respectively such that $s_1 > s_2$ then $s_1 - s_2$ is relative speed



ii) Opposite Direction

Relative Speed = $S_1 + S_2$

Ex A thief is noticed by a policeman from a distance of 200 m. The thief starts running and the policeman chases him. The thief & police men run 10 km/hr & 11 km/hr respectively. What if the distance b-etn them after 6 minutes.

Relative speed of polic

$= 11 - 10 = 1$ km/hr

$= 1 \times \frac{5}{18}$ m/sec

Distance covered in 6 minutes.

$= \frac{5}{18} \times 6 \times 60 = 100$ m // sec //

Remaining distance = 200 m − 100 m

$= 100$ m //

=> IMP for mulch.

1. If the new speed is $\frac{a}{b}$ of the original speed, then the change in time taken to cover the same distance

Change in time $= \left(\frac{b}{a} - 1\right) \times$ original time

2. If a man travels at the speed of x km/hr reach it's late and if he travels at the speed of y km/hr reach it's early the travel distance

$$\frac{xy}{y-x}(t_1+t_2)\ km.$$

iii) if two persons A and B start at the same time from point p and Q towards each other and after crossing they take T_1 & T_2 hrs in reaching Q and P respectively, then

$$\frac{A\text{'s speed}}{B\text{'s speed}} = \sqrt{\frac{T_2}{T_1}} \quad (A) \qquad \boxed{\frac{T_2}{T_1}}$$

2. if a man [illegible]

Ex: If a man travels $\frac{3}{4}$th of his original speed then he reach 20 minute late. Find his actual time.

PMS = 60 min.

→ Let the actual speed x km/hr and actual time t.

$$\frac{1}{\frac{3x}{4}} - \frac{1}{x} = \frac{20}{60}$$

$$\frac{4}{3x} - \frac{1}{x} = \frac{1}{3} \Rightarrow x = 1 \text{ km/hr} \Rightarrow$$

$$\text{Actual time} = \frac{1}{1} = 1 \text{ hr} = 60 \text{ min.}$$

Or

$$\text{Actual time} = \frac{3}{(4-3)} \times 20$$

$$= \frac{3}{1} \times 20 = 60 \text{ min.}$$

or

$$\frac{t}{t+20} = \frac{3}{4} \Rightarrow 4t = 3t + 60 \Rightarrow t = 60 \text{ min}$$

Ex: Ritu goes at the speed of 4 km/hr, reaches her school 6 mins late and next day she goes speed of 5 km/hr reaches 6 mins early find the distance between her home and school?

→ Let Distance = x

$$\frac{x}{4} - \frac{x}{5} = \frac{12}{60} \Rightarrow \frac{x}{20} = \frac{1}{5} \Rightarrow x = 4 \text{ km}$$

OR.

$$\text{Distance} = \frac{5 \cdot 4}{5-4} \left(\frac{6+6}{60}\right) \Rightarrow \frac{20}{1} \times \frac{12}{60}$$

$$\Rightarrow 4 \text{ km}$$