Time speed distance:

* The relation between 'distance' 'speed and time is D x S * T.

* Hence $\frac{S_1T_1}{D_1} = \frac{S_2T_2}{D_2}$ (or) $\frac{D_1}{S_1T_1} = \frac{D_2}{S_2T_2}$ and

$D = S * T$, $S = \frac{D}{T}$, $T = \frac{D}{S}$

* To convert speed from kmph to m/sec we have to multiply with 5/18

* m/sec = 18/5 kmph

* If the ratio of speeds of A and B is a:b then the ratio of times taken by them to cover the same distance is B:A

* If speed and time increases by x% and y% respectively then the distance travelled increased by $\left(x + y + \frac{xy}{100}\right)\%$.

* If speed and time both ↓ by x% and y% respectively then the distance travelled decreased by $\left(x + y - \frac{xy}{100}\right)\%$.

* If speed ↑ by x% and time decreases by y% respectively then distance travelled also changes by $\left(x - y - \frac{xy}{100}\right)\%$.

* If $x - y - \frac{xy}{100}$ is +ve then there is increases (dist).

* If $x - y - \frac{xy}{100}$ is -ve then the distance travelled increases.

* If $x - y - \frac{xy}{100}$ is 0 then the distance travelled does not change.

* If speed increases by x%. then the time decreases by $\left(\frac{x}{100+x}\right)100\%$. to cover the same distance.

* If speed ↓ by x%. then the time ↑ by $\left(\frac{x}{100-x}\right)$ to cover the same distance.

* If time ↑ by x%. then the speed decreases by $\left(\frac{x}{100+x}\right)100\%$ to cover the same distance.

* If time ↓ by x%. then the speed ↑ by $\left(\frac{x}{100-x}\right)100\%$. to cover the same distance.

Avg Speed:

Avg speed is the distance to that of total time taken

$$\text{Avg speed} = \frac{\text{Total distance travelled}}{\text{Total time taken.}}$$

* suppose a man covers a certain distance at 'x' kmph and an equal distance at 'y' kmph then the avg speed during the journey is $\frac{2xy}{x+y}$ kmph

* suppose a man covers n equal distances with speeds $x_1, x_2, x_3 \ldots x_n$ kmph. Then the avg speed during the journey is

$$\frac{x1}{\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + \cdots \frac{1}{x_n}} \text{ kmph.}$$

Comparision speed

Relative speed:

comparision of speed of one person with respect to another is called relative speed.

suppose two persons travels diff speeds x kmph y kmph. Then the relative speed of

a) first person with second person is x-y kmph

b) second person with resp to first person is y-x kmph.

If two persons travel with diff speeds x kmph, y kmph resp in the opp direction Then the relative speed of

a) first person with second is x+y kmph

b) second person with respect to 1st person x+y kmph

Points regarding problems based on trains:

* If a train crosess a stationary object having negligible length.

(A man, a pole, a tree or a single post) then it travels a distance of length of the train.

* If a train crosses a stationary object having some length

(a bridge, a platform, a train or another train) then it travels a distance of sum of the length of the train and length of the obj which its crosses.

* If a train crosses the moving objects then the distance are same as above but speeds

are considered as relative speeds.

* If two trains of length 'x' meters and 'y' meters are moving in opp direction with speed x m/sec, y m/sec respectively then the time taken by trains to cross each other is $\frac{x+y}{u+v}$.

* If two trains of length 'x' meters and 'y' meters are moving in same direction with speeds is u m/sec v m/sec resp, then the time taken by the faster train to cross the slower train is $\frac{x+y}{|u-v|}$ sec.

* If two trains strats at the same time in opp direction from two points A and B and after passings each other they complete the journey in a and b hours respectively then the ratio of there speed is $\sqrt{b} : \sqrt{a}$.

*If two persons running on a circular track of length 'c' meters with different speeds x meter persec and y meter persec respectively, then the first meeting time of two persons at any point on the circular track

(i) If they travel on opp direction is $\frac{c}{x+y}$ sec

(ii) If they travel in the same direction is

$$\frac{c}{|x-y|} \text{ sec.}$$

* If two persons running on a circular track of length 'c' meters with diff speeds x m/s and y m/sec respectively. then the first meeting time of two persons at starting

point is L.C.M of $\{\frac{c}{x}, \frac{c}{y}\}$ sec.

Boats and streams:

Downstream:

If a boat travels in the same direction of waterflow then speed of board increases. In this case we say that boat travels in the ~~drow~~ downstream or with tide.

upstream:

If a boat travels in the opp direction of water flow then speed of boat decreases. In this case we say that boat travels in upstream or with aganist tide.

Note:

If a boat travels in stationary water with stream speed of x kmlp and speed of water is y kmlp, then.

(i) speed of boat in downstream $(x+y)$ kmph

(ii) speed of boat in upstream $(x-y)$ kmph

If a boat travels in downstream with a speed of a kmph and in upstream with a speed of 'b' kmph then:

(i) speed of boat in stationary water is $\frac{a+b}{2}$ kmph

(ii) speed of boat in water (or) ~~Speed~~ speed of stream is $\frac{a-b}{2}$ kmph.

1) If the speed and time both ↑ by 20% and 30% respectively then what is the % increased in the distance travelled.

Sol w.k.t $= \frac{20+30+20\times30}{1000}$

$D = S \times T$

↓ ↓

20% 30% = 50+6

= 56%

2) If speed and time both ↓ by 20% and 30% respectively then the distance travelled ↓ by what % ?

Sol w.k.t $= 50-6$

$D = S \times T$ $= 44\%$

↓ ↓ distance travelled = 44%

20 ↓ 30 ↓

$\Rightarrow 20+30-\frac{20\times30}{100}$

3) If the speed increases by 30% and time decreases by x% due to that distance travelled ↓ by 5% and what is the value of x?

A) $x-y-\frac{xy}{100}$.

$30-x-\frac{30x}{100} = -5$

$\Rightarrow 35 = \frac{3x}{10} + x$

$\Rightarrow 350 = 13x \quad x = \frac{350}{13}$

4) If a person travelled 20 km with a speed of 30 kmph and another 40 km with a speed of 90 kmph then what is this avg speed during the whole journey of 160 km

20 km - 30 kmph

40 km - 90 kmph.

$t_1 = \frac{20}{30} = \frac{2}{3}$

$t_2 = \frac{40}{90} = \frac{4}{9}$

Avg. speed = $\frac{\text{distance (total)}}{\text{Total time}}$

$= \frac{60}{\frac{6}{9} + \frac{4}{9}}$

$= \frac{60(9)}{10}$

$= 54.$

5) If a person travelled half of the distance of a speed of 30 kmph and other half at 20 kmph and remaining at 40 kmph, what is the avg. speed of during whole journey is?

A) $t_1 = \frac{2}{30} = \frac{1}{15}$

$t_2 = \frac{1}{10}$ $t_3 = \frac{1}{40}$

Avg speed = $\frac{x + x/2 + x/2}{\frac{x}{30} + \frac{x}{20} + \frac{x}{80}}$

$= \frac{2x + x + x/2}{x(1/30 + \frac{1}{20} + \frac{1}{80})}$

$= \frac{4x/2}{x(1/30 + 1/20 + 1/80)}$

$= \frac{2}{\frac{8+12+3}{240}}$

$= \frac{2 \times 240}{23}$

$= \frac{480}{23}$ kmph.

6) If a person travelled 3 equal distances with different speeds 20 kmph, 40 kmph, 80 kmph. Then what is avg speed of that person during the whole journey is?

A) Ex avg speed = $\frac{3x}{\frac{1x}{20} + \frac{1x}{40} + \frac{1x}{80}}$

$= \frac{3x}{x(\frac{1}{20} + \frac{1}{40} + \frac{1}{80})}$

$= \frac{3}{\frac{4+2+1}{80}} = \frac{3 \times 80}{7}$

$= \frac{240}{7}$

$= 34\frac{2}{7}$ Y.

7) If a person travels with a speed of 20 kmph from his house to office and return back in the same route with a speed of 60 kmph then what is his avg speed during the whole journey is?

A) avg speed $= \frac{2xy}{x+y}$

$= \frac{2(20)(60)}{20+60}$

$x=20$
$y=60$

$= \frac{\overset{1}{\cancel{40}} \times \overset{3}{\cancel{60}}}{\underset{2}{\cancel{80}}}$

$= 30$ kmph

8) If a person travelled 4 equal distances with different speeds, 10 kmph; 20 kmph, 30 kmph and 40 kmph then what is avg speed during the whole journey is?

A) Avg speed $= \frac{4}{\frac{1}{10}+\frac{1}{20}+\frac{1}{40}+\frac{1}{30}}$

$2|1,2,4,3$
$1,1,2,3$

$= \frac{4}{\frac{24+12+8+6}{240}}$

$\frac{24}{\times 4}$
96

$= \frac{4 \times 240}{50}$

$= \frac{96}{5}$

1. A man on tour travels first 160 km at 90 Kmph and the next 160 km at 54 Kmph. The average speed for the first 320 km of the tour is

A) 67.5 Kmph B) 36 Kmph C) 71.11 Kmph D) 71 Kmph

2. A man covers half of his journey by train at 60 km/hr, half of the remaining by bus at 30 kmph and the rest by cycle at 10 kmph. Find his average speed during the entire journey?

A) 32 kmph B) 20 kmph C) 18 kmph D) 24 kmph

3. A man walking at the rate of 5 kmph crosses a bridge in 15 minutes. The length of the bridge (in meters) is

A) 600 B) 750 C) 1000 D) 1250

4. The distance of the college and home of Rajeev is 80km. One day he was late by 1 hour than the normal time to leave for the college, so he increased his speed by 4kmph and thus he reached to college at the normal time. What is the changed (or increased) speed of Rajeev?

A) 28 kmph B) 30 kmph C) 40 kmph D) 20 kmph

5. The distance between two cities A and B is 330 Km. A train starts from A at 8 A.M. and travel towards B at 60 kmph. Another train starts from B at 9 A.M and travels towards A at 75 Kmph. At what time do they meet?

A) 10 A.M B) 10.30 A.M C) 11 A.M D) 11.30 A.M

6. A man reaches his office 20 min late, if he walks from his home at 3 kmph and reaches 30 min early if he walks 4 kmph. How far is his office from his house?

A) 20 km B) 16 km C) 14 km D) 10 km

7. A train overtakes two girls who are walking in the opposite direction in which the train is going at the rate of 3 kmph and 6kmph and passes them completely in 36 sec and 30 sec respectively. The length of the train is:

A) 120m B) 150m C) 125m D) None of these

8. Two boys starting from the same place walk at a rate of 5kmph and 5.5kmph respectively. What time will they take to be 8.5km apart, if they walk in the same direction?

A) 15 hours B) 16 hours C) 17 hours D) 18 hours

9. A man traveled from the village to the post-office at the rate of 25 kmph and walked back at the rate of 4 kmph. If the whole journey took 5 hours 48 min, find the distance of the post-office from the village?

A) 40 km B) 30 km C) 20 km D) 10 km

10. A train 575 m long crosses a tunnel of length 325 m in 90 sec. What is the speed of the train in kmph.

A) 28 B) 32 C) 36 D) 24

11. Two trains are running in opposite directions in the same speed. The length of each train is 120 meter. If they cross each other in 12 seconds, the speed of each train (in kmph) is

A) 42 B) 36 C) 28 D) 20

12. A train of length 110 meter is running at a speed of 60 kmph. In what time, it will pass a man who is running at 6 kmph in the direction opposite to that in which the train is going?

A) 10 Sec B) 8 Sec C) 6 Sec D) 4 Sec

13. Two stations P and Q are 110 km apart on a straight track. One train starts from P at 7 A.M. and travels towards Q at 20 kmph. Another train starts from Q at 8 A.M. and travels towards P at a speed of 25 kmph. At what time will they meet?

A) 10.30 A.M B) 10.00 A.M C) 8.45 A.M D) 9.30 A.M

14. A train moves pass a telegraph post and a bridge 264 m long in 8 seconds and 20 seconds respectively. What is the speed of the train?

A) 69.5 kmph B) 70 kmph C) 79 kmph D) 79.2 kmph

15. A goods train runs at the speed of 72 kmph and crosses a 250 m long platform in 26 seconds. What is the length of the goods train?

A) 230 m B) 240 m C) 260 m D) 270 m

16. A train 125 m long passes a man, running at 5 kmph in the same direction in which the train is going, in 10 seconds. The speed of the train is?

A) 45 kmph B) 25 kmph C) 30 kmph D) 50 kmph

17) A jogger is running at 9 kmph alongside a railway track is 240 meters ahead of the engine of a 120 meters long train running at 45 kmph in the same direction. In how much time will the train pass the jogger?

A) 48 sec B) 36 sec C) 18 sec D) 72 sec

18) Two trains are moving in opposite directions at 60 kmph and 90 kmph. Their lengths are 1.10 km and 0.9 km respectively. The time taken by the slower train to cross the faster train in seconds is ?

A) 42 sec B) 44 sec C) 46 sec D) 48 sec

19. A person riding a bike crosses a bridge with a speed of 54 kmph. What is the length of the bridge, if he takes 4 min to cross the bridge?

A) 3600 m B) 2800 m C) 3500 m D) 4500 m

20. A boat sails 15 km of a river towards upstream in 5 hours. How long will it take to cover the same distance downstream, if the speed of current is one-fourth the speed of the boat in still water?

A) 1.8h B) 3h C) 4h D) 5h

21. A steamer moves with a speed of 4.5 km/h in still water to a certain upstream point and comes back to the starting point in a river which flows at 1.5 km/h. The average speed of steamer for the total journey is

A) 12 km/h B) 10 km/h C) 6 km/h D) 4 km/h

22. A boy can swim in still water at 4.5 km/h, but takes twice as long to swim upstream than downstream. The speed of the stream is?

A) 1.8 kmph B) 2 kmph C) 2.2 kmph D) 1.5 kmph

23. A boat running upstream takes 8 hours 48 minutes to cover a certain distance, while it takes 4 hours to cover the same distance running downstream. What is the ratio between the speed of the boat in still water and speed of the current respectively?

A) 7:4 B) 11:4 C) 4:7 D) 8:3

24. A man can row upstream at 16 km/hr and downstream at 24 km/hr. Find the ratio speed of the current to that speed of man in still water.

A) 1 : 5 B) 1 : 4 C) 1: 3 D) 1 : 2

25. If sum of upstream and downstream speed of a boat is 82 kmph, and the boat travels 105 km upstream in 3 hr, Find the time taken by boat to cover 126.9 km downstream.

A) 2.8 hrs B) 2.7 hrs C) 2.6 hrs D) 2.5 hrs

26. A train Express A leaves Delhi at 5 A.M and reaches Mumbai at 9 A.M. Another train Express B leaves Mumbai at 7 A.M and reaches Delhi at 10.30 A.M. At what time do they cross each other after 7 A.M ?

A.50m B.52m C.54m D.56m E. None

27) Two trains of equal length, running with the speeds of 40 kmph and 60 kmph, take 40 seconds to cross each other while they are running in the same direction. What time will they take to cross each other if they are running in opposite directions?

A. 8 sec. B. 10 sec. C. 12 sec. D. 9 sec. E. 6 sec.

28) The respective ratio between the speed of the boat upstream and speed of the boat downstream is 4: 9. What is the speed of the boat in still water if it covers 84 km downstream in 2 hours 20 minutes? (in km/h)

A. 24 B. 26 C. 22 D. 28 E. 30

29) A train 350m long takes 35s to cross a man running at a speed of 5 kmph in the direction same to that of train. What is the speed of the train?

A. 40kmph B. 41kmph C. 42kmph D. 43kmph E. None

30) A train 200 m long running at 36 kmph takes 55 seconds to cross a bridge. The length of the bridge is

A. 375 m. B. 300 m. C. 350 m. D. 325 m. E. None

1) $Avg = \frac{2xy}{x+y}$

$= \frac{2 \times 90 \times 54}{90+54}$

$= \frac{180 \times 54}{144}$ $\quad = \frac{135}{2} = 67.5$

72

36

4862

45 × 3 = 135

2) $avg = \frac{4x}{\frac{2x}{60} + \frac{x}{30} + \frac{x}{10}}$

$= \frac{4x}{\frac{2x + 2x + 6x}{60}}$

$= \frac{4x \times 60^{6}}{10x}$

$= 24 \cdot \frac{d}{\frac{15}{60}}$

3) $S = \frac{d}{t} = \frac{15}{60}$

$S = \frac{d}{\frac{15}{60}}$

$300 = \frac{d}{15}$ $\quad d = \frac{15 \times 15}{60_4}$

$d = \frac{5}{4} = 1.25\,km$

$\times 1000$

$= 1250$

60, 30, 10 | 3
20, 10, 10 | 2
10, 5, 5 | 2
5, 5 | 5
1 1

4) (C) (D) 80km

$T_2 - T_1 = 1$

$x = \frac{80}{t}$ $\quad \frac{80}{x-4} - \frac{80}{x} = 1$

$320 = x(x-4)$

$320 = 16 \times 20$

$16 \times 20 = x(x-4)$ $\quad x = 20\,km$

P14

5) 1 - 60 $x - 60x$

2 - 75 $x - 4$ hrs $75 \times (x - 4)$

$$60x + 75(x-1) = 330$$

$$60x + 75x - 75 = 330$$

$$135x = 330 + 75$$

$$x = \frac{405}{135}$$

$$x = 3 \text{ hrs}$$

R.T = 3hrs + 8 = 11 A.m

60
75
135
330

6) 20 + 30 - 50 min.

H.O - x. $\frac{x}{3} + \frac{x}{4} = 50$ min

Diff of time $= \frac{x}{3} - \frac{x}{4} = \frac{20+30}{60}$

$$\frac{4x - 3x}{12}$$

$$\frac{x}{12} = \frac{50}{60}$$

$$6x = 60$$

$$x = 10 \text{ km}.$$

7) 1st girl $= 3 \times \frac{5}{18} = \frac{15}{18}$

2nd $= 6 \times \frac{5}{18} = \frac{30}{18}$

y mts

$$\frac{x}{y + \frac{15}{16}} = 36 \Rightarrow x = 36y + 30 \rightarrow ①$$

$x = 30y + 50$

$y = 150$

8) $R = 5.5 - 5 = 0.5$ kmlhr.

$D = 8.5$ km

$t = \frac{d}{s} = \frac{8.5}{0.5} = \frac{85}{5} = 17$

9) di- V - P.O - x km.

T.D = 2x. & T. time is - 5hr. 48 m. $\frac{48}{60}$

T.D :- $= \frac{29}{5}$ hrs.

Aug speed $= \frac{2x}{\frac{29}{5}}$

$= \frac{2x \times 5}{29} = \frac{10x}{29}$

But - $\frac{2 \times 25 \times 4}{25+4} = \frac{50 \times 4}{29} = \frac{10x}{29}$ $\quad 10x = 200$

$x = 20$ km. $\quad x = \frac{200}{10}$

11) D. T = 240 = $\frac{240}{12}$

RS = 2x

T = 12

$2x = \frac{240}{12} = 20$

$x = 10$ m/s

$= 10 \times \frac{18}{5}$

$= 36$ kmph.

12) 110 - 60 kmph.

? - 6 km

$\frac{110 \times 6}{60} = 11$

D = 110 m

S = 66 kmph.

$\frac{66 \times 5}{18} = \frac{55}{3}$ m/s

$T.K = \frac{D}{S} = \frac{110}{\frac{55}{3}}$

$= \frac{110 \times 3}{55} = 6$ sec

13) let both the trains meet each other t hrs after 7 AM.

∴ D travelled by the train started P is $20 \times T$.

IInd pistance travelled by Q is $25 \times (T-1)$

$\therefore 20T + 25T - 25 = 110$

$45T = 135$

$T = 3$ hrs.

$\therefore (7+3 = 10 \text{ hrs})$

∴ The meet each other at 10 AM.

14) le. of the train = x m/s

speed of time = $\frac{x}{8}$ m/s

Then

$264 + x = \frac{x}{8} \times \frac{10}{20}$ (5)

$264 + x = \frac{5x}{2}$

$\frac{3x}{2} = 264$

$x = 176$

$S = \frac{176}{8}$

$= 22$ m/s.

$\therefore 22 \times \frac{18}{5} = 4 \cdot 4 \times 18$

$= 79.2$ Phr.

15) leng of train = x

D. T = $x + 250$

speed = 72 kmph

$S = 72 \times \frac{5}{18} = 20$ m/sc

T = 26 sc

D = S x T

$\Rightarrow x + 250 = 20 \times 26$

$x + 250 = 520$

$x = 520 - 250$

$x = 270$ m.

16) RS = $x - 5$ kmph

$\Rightarrow (x-5) \frac{18}{5} 5$

T = 10

D = 125

D $\Rightarrow 125 = (x-5) \frac{18}{5} \times 10$ (5)

$\frac{125}{5} = \frac{(x-5)25}{9}$ (9)

$x = 50$ kmph.

17) $240 + 120 = 360$

RS = $45 - 9 = 36$ km

$36 \times \frac{5}{18} = 10$ m/s (2)

$\therefore T = \frac{D}{S}$

$T = \frac{360}{10}$

$T = 36$ sec.

18) R.S = 60+90 = 150 kmph

D.T = 1.1+0.9 = 2 km.

$T = \frac{D}{S} = \frac{2}{150}$ hrs.

$= \frac{2}{150} \times 3600$

= 48 sec.

20) $S = 54 \times \frac{5}{18}$

S = 15 m/s.

T = 4 × 60 = 240.

D = S × T = 15 × 4 × 60

= 60 × 60

= 3600 m.

20) Speed of s.w = x kmph

speed of stream = $\frac{x}{4}$ kmph

∴ s.b upstream = $x - \frac{x}{4}$

$= \frac{3x}{4} \Rightarrow \frac{15}{5}$

D = 15 T = .5 hrs. in up stream.

x = 4 kmph.

Down stream = $x + \frac{x}{4}$ = 5 km.

t = 15

$T_{DS} = \frac{D}{S} = \frac{15}{8} = 3h.$

21) S. of $B_{DS} = x = 4.5$

+1.5 = 6

$S_{up} = y = 4.5 - 1.5 = 3.$

Avg speed = $\frac{2xy}{x+y}$

$= \frac{2 \times 6 \times 3}{6+3}$

$= \frac{36}{9} = 4$ kmph.

22) $2\left(\frac{x}{4.5+y}\right) = 2\left(\frac{x}{4.5-y}\right)$

4.5 + y = 9 - 2y

3y = 4.5

y = 1.5

$T_{UB} = 2 \times T_{DS}$.