CHAPTER

9 TIME, SPEED & DISTANCE

In this chapter, we will learn about the following two types of questions :

(i) Time, Speed and Distance

(ii) Boat and Stream

TIME, SPEED AND DISTANCE

Speed:

The distance covered per unit time is called speed. Speed is directly proportional to distance and inversely to time

- Distance = speed × time
- Speed = $\frac{\text{distance}}{\text{time}}$
- Time = $\frac{\text{distance}}{\text{speed}}$

Main Units

- **Time :** Seconds, minutes, hours
- **Distance :** meter, kilometer
- **Speed :** km/ hr, m /sec

Conversion

- 1 km / hr = $\frac{5}{18}$ metre / second
- 1 metre / second = $\frac{18}{5}$ km / hr
- 1 Km/hr = $\frac{5}{8}$ mile / hr
- 1 mile / hr = $\frac{22}{15}$ foot / second

ILLUSTRATION 1: A scooter travels at the speed of 45 kmph. What is the distance covered by the scooter in 4 minutes ?

Sol. Speed of scooter = 45 km / hr

$$= \frac{45 \times 1000}{60} = 750 \text{ metre / minute}$$

$\therefore$ Distance covered in 4 minutes

$$= 4 \times 750 = 3000 \text{ metre} = 3 \text{ km}$$

Quicker Method to solve the questions on Time, Speed and Distance

- **Average speed: The average speed is given by total distance divided by total time taken.**
- Average Speed = $\frac{\text{Total Distance}}{\text{Total Time}}$

$$= \frac{(d_1 + d_2 + d_3 + \ldots\ldots d_n)}{(t_1 + t_2 + \ldots\ldots\ldots t_n)}$$

- **The average speed in case of a journey from X to Y at speed of A m/sec and returning back to X at a speed of B m/sec, is**

$$\left[\frac{2AB}{(A+B)}\right] \text{ metre / second}$$

ILLUSTRATION 2 : Sunil travels from Delhi to Patna at the speed of 40 km/hr and returns at the speed of 50 km/hr. What is the average speed of the journey?

Sol. Using the formula,

$$\left[\frac{2AB}{(A+B)}\right] = \frac{2 \times 40 \times 50}{40 + 50}$$

$$= \frac{4000}{90} = 44.44 \text{ Km/hr}$$

- **Relative speed**

As the name suggests, the concept is regarding the relative speed between two or more objects. The basic concept in relative speed is that speeds get added in case objects are moving from opposite directions and get subtracted in case objects are moving in the same direction. For example, if two trains are moving in opposite directions with a speed of X km/hr and Y km/hr respectively, then $(X + Y)$ is their relative speed. In the other case if two trains are moving in the same direction with a speed of X km/hr and Y km/hr respectively, then $(X - Y)$ is their relative speed.

For the first case the time taken by the trains in passing each other

$= \frac{L_1 + L_2}{(X+Y)}$ hours,

where L_1 and L_2 are lengths of the trains.
For the second case the time taken by the trains in passing each other

$= \frac{L_1 + L_2}{(X-Y)}$ hours,

where L_1 and L_2 are lengths of the trains.

ILLUSTRATION ▶ 3 : Two trains, 100 m and 80 m in length are running in the same direction. The first runs at the rate of 51 m/s and the second at the rate of 42 m/s. How long will they take to cross each other?

Sol. Here Length of first train = 100m,
Length of second train = 80m
And Speed of first train = 51 m/s
Speed of second train = 42 m/s
Relative speed = 51 - 42 = 9 m/s
(since trains are running in the same direction)

As per the formula = $\frac{L_1 + L_2}{x - y}$

$= \frac{100+80}{9} = 20$ seconds

ILLUSTRATION ▶ 4 : Two trains, 100 m and 80 m in length are running in opposite directions. The first runs at the rate of 10 m/s and the second at the rate of 15 m/s. How long will they take to cross each other?

Sol. Here Length of first train = 100 m
Length of second train = 80 m
And Speed of first train = 10 m/s
Speed of second train = 15 m/s
Relative speed = 10 + 15 = 25 m/s
(since trains are running in opposite directions)

As per the formula = $\frac{L_1 + L_2}{x + y}$

$= \frac{100+80}{25} = 7.2$ seconds

❖ **The time taken by a train X meters long to pass a signal post is the time taken for the train to cover X meters.**

ILLUSTRATION ▶ 5 : A train 300 meters long has a speed of 10 m/s. How long will it take to pass an electric pole?

Sol. Time = $\frac{\text{Distance}}{\text{Speed}}$

the distance here will be same as the length of the train.
That is 300 meters.

$\therefore$ Time = $\frac{300}{10} = 30$ seconds

❖ **The time taken by a *x* meters long train in passing any object which is *y* meters long is the time taken for the train to cover the distance *x* + *y*.**

ILLUSTRATION ▶ 6 : A train 300 meters long has a speed of 10 m/s. How long will it take to pass a platform of 50 meters?

Sol. Time = $\frac{\text{Distance}}{\text{Speed}}$

The distance here will be same as the length of the train + the length of the platform.
This is 300 + 50 = 350 m

Therefore, Time = $\frac{350}{10} = 35$ seconds

BOAT AND STREAM

When we move upstream, our speed gets deducted from the speed of the stream. Similarly when we move downstream our speed gets added to the speed of the stream.

Let the speed of a boat in still water be A km/hr and the speed of the stream (or current) be B km/hr, then

- Speed of boat with the stream = (A + B) km/hr
- Speed of boat against the stream = (A - B) km/hr

Quicker Method to solve the questions on Boat and Stream

❖ **Boat's speed in still water**

$= \frac{\text{speed downstream + speed upstream}}{2}$

ILLUSTRATION ▶ 7: A boat travels equal distances upstream and downstream. The upstream speed of boat was 10 km/hr, whereas the downstream speed is 20 km/hr. What is the speed of the boat in still water?

Sol. Upstream speed = 10 km/hr
Downstream speed = 20 km/hr
As per formula, Boat's speed in still water

$= \frac{\text{speed downstream + speed upstream}}{2}$

Therefore, Boat's speed in still water

$= \frac{10+20}{2} = 15$ km/hr

❖ **Speed of current**

$= \frac{\text{Speed downstream} - \text{Speed upstream}}{2}$

ILLUSTRATION ▶ 8 : A boat travels equal distance upstream and downstream. The upstream speed of boat is 10 km/hr, whereas the downstream speed is 20 km/hr. What is the speed of the current?

Sol. Upstream speed = 10 km/hr
Downstream speed = 20 km/hr
As per formula, Speed of current

$= \frac{\text{Speed downstream} - \text{Speed upstream}}{2}$

Therefore, Speed of current

$= \frac{20-10}{2} = \frac{10}{2} = 5$ km/hr

SOLVED EXAMPLES

EXAMPLE ▶ 1: A 175 meters long train crosses a 35 meters platform in 12 seconds. What is the speed of the train in km/ hr ?

(a) 42 **(b) 64**
(c) 63 **(d) 59**
(e) None of these

Sol. (c) Speed of train

$$= \frac{\text{Length (platform + train)}}{\text{Time}}$$

$$= \frac{175+35}{12} = \frac{210}{12} = \text{m/s}$$

$$= \frac{210}{12} \times \frac{18}{5} \text{ kmph} = 63 \text{ kmph.}$$

EXAMPLE ▶ 2 : A train running at speed of 90 km per hour crosses a platform double its length in 36 seconds. What is the length of the platform in meters ?

(a) 450 **(b) 200**
(c) 600 **(d) Cannot be determined**
(e) None of these

Sol. (c) Let the length of the train be = x metres

$\therefore$ Length of the platform = 2x metres

Speed of train = 90 kmph

$$= 90 \times \frac{5}{18} = 25 \text{ m/sec.}$$

According to the question,

$$\frac{x+2x}{25} = 36$$

or, $3x = 25 \times 36$

or, $x = \frac{25 \times 36}{3} = 300 \text{ m}$

$\therefore$ length of platform = 2x = 600 m

EXAMPLE ▶ 3 : A car travels a distance of 75 km at the speed of 25km/ hr. It covers the next 25 km of its journey at the speed of 5 km/hr and the last 50 km of its journey at the speed of 25 km/ hr. What is the average speed of the car?

(a) 40 km/hr **(b) 25km/hr**
(c) 15 km/hr **(d) 12.5km/hr**
(e) None of these

Sol. (c) Time taken to cover first 75 km of distance

$$= \frac{75}{25} = 3 \text{ hours}$$

Time taken to cover next 25 km of distance

$$= \frac{25}{5} = 5 \text{ hours}$$

Time taken to cover last 50 km of its journey

$$= \frac{50}{25} = 2 \text{ hours}$$

Total distance = 75 + 25 + 50 = 150 km

Total time taken = 3 + 5 + 2 = 10 hours

$\therefore$ Average speed = $\frac{150}{10} = 15$ kmph.

EXAMPLE ▶ 4: Raman drove from home to another town at the speed of 50km/hr and on his return journey, he drove at the speed of 45km/hr and took an hour longer to reach home. What distance did he cover each way?

(a) 450 km **(b) 225 km**
(c) 900 km **(d) 500 km**
(e) None of these

Sol. (a) Let the distance be x km.

Then, $\frac{x}{45} - \frac{x}{50} = 1$

$$\Rightarrow x = \frac{45 \times 50}{5} = 450 \text{ Km.}$$

EXAMPLE ▶ 5 : A 240 - meter long train running at the speed of 60 kmph will take how much time to cross another 270 - meter long train running in the opposite direction at the speed of 48 kmph ?

(a) 17 seconds **(b) 3 seconds**
(c) 12 seconds **(d) 8 seconds**
(e) None of these

Sol. (a) Relative speed

$$= (60 + 48) \times \frac{5}{18}$$

= 30 m/sec.

$\therefore$ Time taken

$$= \frac{240+270}{30}$$

$$= \frac{510}{30}$$

= 17 seconds

EXERCISE

1. A car covers a distance of 816 kms in 12 hours. What is the speed of the car ?
   (a) 60kmph (b) 62kmph
   (c) 64kmph (d) cannot be determined
   (e) None of these
2. A bus covers a distance of 2,924 kms in 43 hours. What is the speed of the bus?
   (a) 72 kmph (b) 60kmph
   (c) 68kmph (d) Cannot be determined
   (e) None of these
3. A train covers a distance of 1560 kms in 26 hours. What is the speed of the train?
   (a) 72 kms/hr (b) 62 kms/hr
   (c) 68 kms/hr (d) Cannot be determined
   (e) None of these
4. A bus travels at the speed of 49 kmph and reaches its destination in 7 hours. What is the distance covered by the bus?
   (a) 343km (b) 283km
   (c) 353km (d) 245km
   (e) 340km
5. A car travels a distance of 45 kms at the speed of 15 kmph. It covers the next 50 kms of its journey at the speed of 25 kmph and the last 25 kms of its journey at the speed of 10 kmph. What is the average speed of the car?
   (a) 40 kmph (b) 24 kmph
   (c) 15 kmph (d) 18 kmph
   (e) None of these
6. Nilesh goes to school from his village & returns at the speed of 4 km/hr. If he takes 6 hours in all, then what is the distance between the village and the school?
   (a) 6km (b) 5km
   (c) 4km (d) Cannot be determined
   (e) None of these
7. A 200 meter long train crosses a platform double its length in 36 seconds. What is the speed of the train in km/hr ?
   (a) 60 (b) 48
   (c) 64 (d) 66
   (e) None of these
8. A 160 meter long train running at a speed of 90 km/h crosses a platform in 18 seconds. What is the length of the platform in meters?
   (a) 210 (b) 240
   (c) 290 (d) 310
   (e) None of these
9. Excluding the stoppages, the speed of a bus is 64 km/hr and including the stoppages the speed of the bus is 48 km/hr. For how many minutes does the bus stop per hour?
   (a) 12.5 minutes (b) 15 minutes
   (c) 10 minutes (d) 18 minutes
   (e) None of these
10. A car covers a distance of 540 km in 9 hours. Speed of a train is double the speed of the car. Two-third the speed of the train is equal to the speed of a bike. How much distance will the bike cover in 5 hours ?
    (a) 450 km (b) 360 km
    (c) 400 km (d) 500 km
    (e) None of these
11. The ratio between the speed of a train and a car is 18 : 13 . Also, a bus covered a distance of 480 kms. in 12 hours. The speed of the bus is five-ninth the speed of the train. How much distance will the car cover in 5 hours ?
    (a) 250 km. (b) 280 km.
    (c) 260 km. (d) Cannot be determined
    (e) None of these
12. A 300 meter long train moving with an average speed of 126 km/hr crosses a platform in 24 seconds. A man crosses the same platform in 5 minutes. What is the speed of the man in meters/second
    (a) 1.8 m/s (b) 1.2 m/s
    (c) 1.5 m/s (d) Cannot be determined
    (e) None of these
13. Train A crosses a stationary train B in 35 seconds and a pole in 14 seconds with the same speed. The length of the train A is 280 meters. What is the length of the stationary train B ?
    (a) 360 meters (b) 480 meters
    (c) 400 meters (d) Cannot be determined
    (e) None of these
14. A bike covers a certain distance at the speed of 64 km/hr in 8 hours. If a bike was to cover the same distance in approximately 6 hours, at what approximate speed should the bike travel?
    (a) 80 km./hr. (b) 85 km/hr.
    (c) 90 km./hr. (d) 75 km/hr.
    (e) 70 km./hr
15. A train running between two stations A and B arrives at its destination 10 minutes late when its speed is 50 km/h and 50 minutes late when its speed is 30km/h. What is the distance between the stations A and B ?
    (a) 40 km (b) 50 km
    (c) 60 km (d) 70 km
    (e) None of these
16. A train covered a certain distance at a uniform speed. If the train had been 6 km/h faster, then it would have taken 4 hours less than the scheduled time. And, if the train were slower by 6 km/h, then the train would have taken 6 hours more than the scheduled time. The length of the journey is
    (a) 700 km (b) 740 km
    (c) 720 km (d) 760 km
    (e) None of these
17. On a journey across Bombay, a tourist bus averages 10 km/h for 20% of the distance, 30 km/h for 60% of it and 20 km/h for the remainder. The average speed for the whole journey was
    (a) 10 km/h (b) 30 km/h
    (c) 5 km/h (d) 20 km/h
    (e) None of these

18. A train leaves station X at 5 a.m. and reaches station Y at 9 a.m. Another train leaves station Y at 7 a.m. and reaches station X at 10: 30 a.m. At what time do the two trains cross each other ?
(a) 7 : 36 am (b) 7 : 56 am
(c) 8 : 36 am (d) 8 : 56 am
(e) None of these

19. A man rides a horse at the rate of 11 miles an hour, but stops for 5 min to change horse at the end of every seventh mile. How long will he take to cover a distance of 96 miles ? (Approx.)
(a) 7 hr. 20 min. (b) 6 hr. 25 min.
(c) 8 hr. 42 min. (d) 9 hr. 48 min.
(e) None of these

20. A man starts from B to K and another from K to B at the same time. After passing each other they complete their journeys in $3\frac{1}{3}$ and $4\frac{4}{5}$ hours, respectively. Find the speed of the second man if the speed of the first is 12 km/hr.
(a) 12.5 kmph (b) 10 kmph
(c) 12.66 kmph (d) 20 kmph
(e) None of these

21. The driver of a car driving @ 36 kmph locates a bus 40 meters ahead of him. After 20 seconds the bus is 60 meters behind. The speed of the bus is :
(a) 36 kmph (b) 20 m/sec.
(c) 72 m/sec. (d) 18 kmph
(e) None of these

22. Two trains 100 meters and 120 meters long are running in the same direction with speeds of 72 km/h and 54 km/h. In how much time will the first train cross the second?
(a) 50 sec (b) 44 sec
(c) 38 sec (d) 42 sec
(e) None of these

23. A train overtakes two persons walking along a railway track. The first one walks at 4.5 km/h. The other one walks at 5.4 km/h. The train needs 8.4 and 8.5 seconds respectively to overtake them. What is the speed of the train if both the persons are walking in the same direction as the train?
(a) 66 km/h (b) 72 km/h
(c) 78 km/h (d) 81 km/h
(e) None of these

24. A train 100 metres long takes $3\frac{3}{5}$ seconds to cross a man walking at the rate of 6 km/h in a direction opposite to that of the train. Find the speed of the train.
(a) 94 m/s (b) 100 m/s
(c) 110 m/s (d) 108 m/s
(e) None of these

25. Subbu starts from a point O at 10:00 a.m., overtakes Ajay, who is moving in the same direction, at 11:00 a.m. and Bhuvan moving in the opposite direction at 12:00 (noon). If the speed of Bhuvan is one fourth the speed of Subbu, at what time will Ajay and Bhuvan cross each other ?
(a) 1 : 30 p.m. (b) 2:00 p.m.
(c) 2 : 30 p.m. (d) Cannot be determined
(e) None of these

26. A monkey ascends a greased pole 12 meters high. He ascends 2 meters in the first minute and slips down 1 meter in the next minute and so on . In which minute does it he reaches the top?
(a) 21st (b) 22nd
(c) 23rd (d) 24th
(e) None of these

27. A man covers a certain distance on a scooter. If the scooter moved 4 km/h faster, it would take 30 minutes less. If it moved 2 km/h slower, it would have taken 20 minutes more. Find the distance.
(a) 60 km (b) 58 km
(c) 55 km (d) 50 km
(e) None of these

28. A boat running downstream covers a distance of 16 km in 2 hours while for covering the same distance upstream, it takes 4 hours. What is the speed of the boat in still water?
(a) 4 km/h (b) 6 km/h
(c) 8 km/h (d) Data inadequate
(e) None of these

29. R and S start walking towards each other at 10 AM at the speeds of 3 km/h and 4 km/h respectively. They were initially 17.5 km apart. At what time do they meet?
(a) 2 : 30 PM (b) 11 : 30 AM
(c) 1 : 30 PM (d) 12 : 30 PM
(e) None of these

30. In a 800 m race around a stadium having the circumference of 200 m, the top runner meets the last runner on the 5th minute of the race. If the top runner runs at twice the speed of the last runner, what is the time taken by the top runner to finish the race ?
(a) 20 min (b) 15 min
(c) 10 min (d) 5 min
(e) None of these

31. A long distance runner runs 9 laps of a 400 meters track everyday. His timings (in minutes) for four consecutive days are 88, 96, 89 and 87 resplectively. On an average, how many meters/minute does the runner cover ?
(a) 40 m/min (b) 45 m/min
(c) 38 m/min (d) 49 m/min
(e) None of these

32. Mohan travels 760 km to his home, partly by train and partly by car. He takes 8 hours if he travels 160 km by train and the rest by car. He takes 12 minutes more if he travels 240 km by train and the rest by car. The speed of the train and the car, respectively are:
(a) 80 km/h, 100 km/h (b) 100 km/h, 80 km/h
(c) 120 km/h, 120 km/h (d) 100 km/h, 120 km/h
(e) None of these

33. A boy rows a boat against a stream flowing at 2 kmph for a distance of 9 km, and then turns round and rows back with the current. If the whole trip occupies 6 hours, find the boy's rowing speed in still water.
(a) 4 kmph (b) 3 kmph
(c) 2 kmph (d) 5 kmph
(e) None of these

Answer Key

1	**(e)**	8	**(c)**	15	**(b)**	22	**(b)**	29	**(d)**
2	**(c)**	9	**(b)**	16	**(c)**	23	**(d)**	30	**(c)**
3	**(e)**	10	**(c)**	17	**(d)**	24	**(a)**	31	**(a)**
4	**(a)**	11	**(c)**	18	**(b)**	25	**(d)**	32	**(a)**
5	**(e)**	12	**(a)**	19	**(d)**	26	**(a)**	33	**(a)**
6	**(e)**	13	**(e)**	20	**(b)**	27	**(a)**		
7	**(a)**	14	**(b)**	21	**(d)**	28	**(b)**		

ANSWERS & EXPLANATIONS

1. (e) $\text{Speed of the car} = \dfrac{\text{Distance Covered}}{\text{Time Taken}}$

$= \dfrac{816}{12} = 68$ kmph.

2. (c) $\text{Speed of bus} = \dfrac{\text{Distance covered}}{\text{Time taken}}$

$= \dfrac{2924}{43} = 68$ kmph.

3. (e) $\text{Speed of train} = \dfrac{1560}{26}$

$= 60$ kmph.

4. (a) Distance covered = Speed × Time
$= 49 \times 7 = 343$km

5. (e) Time taken to cover a distance of 45 kms

$= \dfrac{45}{15} = 3$ hours

Time taken to cover a distance of 50 kms

$= \dfrac{50}{25} = 2$ hours

Time taken to cover distance of 25 kms

$= \dfrac{25}{10} = 2.5$ hours

Total distance = (45 + 50 + 25) kms = 120 kms
Total time = (3 + 2 + 2.5) hours = 7.5 hours

$\therefore$ Required average speed $= \dfrac{120}{7.5} = 16$ kmph

6. (e) Let the distance between the village and the school be x km.
According to the question,

$\dfrac{x}{4} + \dfrac{x}{2} = 6$

or, $\dfrac{x + 2x}{4} = 6$

or, $3x = 6 \times 4$

$\therefore x = \dfrac{6 \times 4}{3} = 8$ km

7. (a) Speed of train

$= \dfrac{(200 + 400)}{36} \times \dfrac{18}{5}$

$= 60$ km/hr.

8. (c) Distance covered in 18 seconds

$= 90 \times \dfrac{5}{18} \times 18 = 450\ m$

$\therefore$ length of platform
$= 450 - 160 = 290$ m

9. (b) Stoppage minutes per hour

$= \dfrac{(64 - 48) \times 60}{64} = 15$ minutes.

10. (c) Speed of car

$= \dfrac{540}{9}$

$= 60$ kms/hr.
Speed of bike

$= 60 \times 2 \times \dfrac{2}{3}$

$= 80$ kms/hr.
Distance covered by bike
$= 80 \times 5$
$= 400$ kms.

11. (c) Speed of bus

$= \dfrac{480}{12} = 40$ km/hr

Speed of train

$= 40 \times \dfrac{9}{5} = 72$ km/hr

Speed of car

$= \frac{72}{18} \times 13 = 52\,\text{km/hr}$

Distance covered by car
$= 52 \times 5 = 260$ km

12. (a) Length of platform

$= 126 \times \frac{5}{18} \times 24 - 300 = 540$ meter

$\therefore$ Speed of man $= \frac{540}{5 \times 60}$

$= 1.8$ meter/second

13. (e) Speed of train A $= \frac{280}{14} = 20$ meter/second

Length of train B $= 20 \times 35 - 280$ meter
$= 700 - 280$ meter
$= 420$ meter

14. (b) Distance $= 64 \times 8$
$= 512$ km

$\therefore$ Speed $= \frac{512}{6}$

$= 85$ km/hr (approx.)

15. (b) Let the distance between the two stations be x km.

Then, $\frac{x}{50} - \frac{10}{60} = \frac{x}{30} - \frac{50}{60}$

$\Rightarrow \frac{x}{50} - \frac{1}{6} = \frac{x}{30} - \frac{5}{6}$

or $\frac{x}{30} - \frac{x}{50} = \frac{2}{3}$ or $x = 50$ km

Thus distance between the station A and B = 50 km

16. (c) Let the length of the journey be x km.
Suppose speed of the train be y km/h.

$\therefore$ Time taken to cover x km $= \frac{x}{y}$ hours

$\therefore$ $\frac{x}{y+6} = \frac{x}{y} - 4,\ \frac{x}{y-6} = \frac{x}{y} + 6$

Solving these equations, we get
$y = 30$, $x = 720$.
$\therefore$ Length of the journey = 720 km.

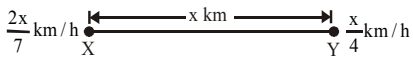
17. (d) Let the average speed be x km/h.
and Total distance = y km. Then,

$\frac{0.2}{10}y + \frac{0.6}{30}y + \frac{0.2}{20}y = \frac{y}{x}$

$\Rightarrow x = \frac{1}{0.05} = 20\,\text{km/h}$

18. (b) Let the distance between X and Y be x km.
Then, the speed of A is

$\frac{x}{4}$ km/h and that of B is $\frac{2x}{7}$ km/h.



Relative speeds of the trains

$= \left(\frac{x}{4} + \frac{2x}{7}\right) = \frac{15x}{28}$ km/h

Therefore the distance between the trains at 7 a.m.

$= x - \frac{x}{2} = \frac{x}{2}$ km

Hence, time taken to cross each other

$= \frac{\frac{x}{2}}{\frac{15x}{28}} = \frac{x}{2} \times \frac{28}{15x} = \frac{14}{15} \times 60 = 56\,\text{min}$

Thus, both of them meet at 7 : 56 a.m.

19. (d)

Time taken to travel 96 miles

$= \frac{96}{11}$ hrs. = 8 hrs and 43 minutes

During the journey of 96 miles, he has to stop for 13 times to change the horse.
$\therefore$ Total stoppage time
$= 13 \times 5 = 65$ mins. = 1 hr and 5 mins.
Hence the total time
= 8 hrs and 43 mins + 1 hr and 5 mins.
= 9 hrs and 48 mins.

20. (b) $\frac{\text{1st man's speed}}{\text{2nd man's speed}} = \frac{\sqrt{b}}{\sqrt{a}} = \frac{\sqrt{b}}{\sqrt{a}} = \sqrt{\frac{4\frac{4}{5}}{3\frac{1}{3}}}$

$= \sqrt{\frac{24}{5} \times \frac{3}{10}} = \sqrt{\frac{36}{25}} = \frac{6}{5}$

$\therefore$ $\frac{12}{\text{2nd man's speed}} = \frac{6}{5}$

$\therefore$ 2nd man's speed $= \frac{60}{6} = 10$ km/hr.

21. (d) Net distance gained by car over the bus
$= 40 + 60 = 100$m, in 20 sec.

$\text{Time} = \frac{\text{Distance}}{\text{Relative speed}}$

$\Rightarrow 20 = \frac{100}{\left(36 \times \frac{5}{18}\right) - S_2}$

$\Rightarrow S_2 = 5$ m/s $= 18$ kmph.

22. (b) Relative speed of the trains
$= (72 - 54)$ km/h $= 18$ km/h

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

Time taken by the trains to cross each other
= Time taken to cover (100 + 120) m at 5 m/sec

$= \left(\frac{220}{5}\right)$ sec = 44 sec.

23. (d) $4.5 \text{ km/h} = \left(4.5 \times \frac{5}{18}\right) \text{ m/sec} = 1.25 \text{ m/sec},$

$\& \; 5.4 \text{ km/h} = \left(5.4 \times \frac{5}{18}\right) \text{ m/sec} = 1.5 \text{ m/sec}.$

Let the speed of the train be S m/sec.
Then, $(S - 1.25) \times 8.4 = (S - 1.5) \times 8.5$
$\Rightarrow 8.4S - 10.5 = 8.5S - 12.75$
$\Rightarrow 0.1S = 2.25 \Rightarrow S = 22.5.$

$\therefore$ Speed of the train $= \left(22.5 \times \frac{18}{5}\right) \text{ km/h} = 81 \text{ km/h}.$

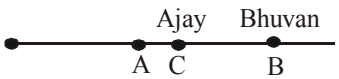
24. (a) Let speed of train be S km/h.
Speed of train relative to man
$= [S - (-6)]$ km/h

$= (S + 6) \times \frac{5}{18} \text{ m/s}$

Now $(S + 6) \times \frac{5}{18} = \frac{100}{18/5}$

$\Rightarrow S = 94 \text{ m/s}$

25. (d) Let the speed of Ajay be V and the speed of Bhuvan and Subbu be 1 and 4 respectively.
Then OA = 4 and OB = 4.
At 12:00 noon.



Let Ajay be at C at 12:00 noon at a distance of V from A (towards B)
$\therefore$ Time taken for them to meet from 12:00 noon.

$= \frac{4 - V}{1 + V}$

Since V is not known $\frac{4 - V}{1 + V}$ cannot be determined.

26. (a) In 2 minutes, he ascends = 1 metre
$\therefore$ 10 metres, he ascends in 20 minutes.
$\therefore$ He reaches the top in 21st minute.

27. (a) Let the distance be x km. Let speed of train be y km/h.
Then by question, we have

$\frac{x}{y + 4} = \frac{x}{y} - \frac{30}{60}$ ...(i)

and $\frac{x}{y - 2} = \frac{x}{y} + \frac{20}{60}$ ...(ii)

On solving (i) and (ii), we get x = 3y
Put x = 3y in (i) we get

$\frac{3y}{y + 4} = 3 - \frac{1}{2} \quad \Rightarrow y = 20$

Hence, distance = 20 × 3 = 60 km.

28. (b) Rate downstream

$= \left(\frac{16}{2}\right)$ kmph = 8 kmph;

Rate upstream

$= \left(\frac{16}{4}\right)$ kmph = 4 kmph.

$\therefore$ Speed in still water

$= \frac{1}{2}(8 + 4) = 6 \text{ km/h}.$

29. (d) Let them meet after t hours, then,
3t + 4t = 17.5 $\Rightarrow$ t = 2.5
$\therefore$ Time = 10 am + 2.5 h = 12 : 30pm

30. (c) After 5 minutes (before meeting), the top runner covers 2 rounds i.e., 400 m and the last runner covers 1 round i.e., 200 m.
$\therefore$ Top runner covers 800 m race in 10 minutes.

31. (a) Average speed $= \frac{\text{Total distance}}{\text{Total time}}$

$= \frac{400 \times 4 \times 9}{88 + 96 + 89 + 87} = \frac{400 \times 4 \times 9}{360}$

= 40 metres /minutes

32. (a) Let speed of the train be x km/h and that of the car be y km/h.

Now, $\frac{160}{x} + \frac{600}{y} = 8$ ...(i)

and $\frac{240}{x} + \frac{520}{y} = \frac{41}{5}$ ...(ii)

Solving (i) and (ii), we have x = 80 km/h and y = 100 km/h.

33. (a) Let the speed of rowing be X. Then the equation formed is $\frac{9}{X - 2} + \frac{9}{X + 2} = 6.$

On solving, we get the value of X as 4.

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