Time, Speed and Distance

Time

The duration in hours, minutes or seconds spent to cover a certain distance is called time.

Speed

Speed is defined as the distance covered in unit time. Hence, it is the rate at which the distance is covered. Units of speed are km/h and m/s etc.

Distance

The length of the path travelled by any object or a person between two places is known as distance.

Relation between Time, Speed and Distance

The speed of a moving body is the distance travelled by it in unit time.

i.e. $\text{Speed} = \dfrac{\text{Distance}}{\text{Time}}$

Example 1 Find the distance covered by a man walking for 12 min at a speed of 3.5 km/h.
(a) 500 m   (b) 200 m
(c) 800 m   (d) 700 m

Sol. *(d)* $\text{Distance} = \text{Speed} \times \text{Time}$

$= 3.5 \times \dfrac{12}{60} \quad \left[\because 12 \text{ min} = \dfrac{12}{60} \text{ h} \right]$

$= \dfrac{7}{10} \text{ km} = 700 \text{ m}$

Example 2 Find the time taken to cover a distance of 124 km by a train moving at 45 km/h.
(a) 4 h 45 min   (b) 2 h 20 min
(c) 2 h 45 min   (d) 3 h 45 min

Sol. *(c)* $\text{Time} = \dfrac{\text{Distance}}{\text{Speed}} = \dfrac{124}{45} \text{ h}$

$= 2\dfrac{34}{45} \text{h} = 2 + \left[\dfrac{34}{45} \times 60 \right]$

$= 2 \text{ h } 45 \text{ min (approx.)}$

Average Speed

It is the ratio of total distance covered in total time.

$\text{Average speed} = \dfrac{\text{Total distance travelled}}{\text{Total time taken}}$

If a man covers a certain distance with speed *a* unit and return back with speed *b* unit, then the average speed of whole journey would be

$\text{Average speed} = \dfrac{2ab}{a+b}$

Example 3 Krishna covers a certain distance by car at a speed of 35 km/h and he returns back to the starting point riding on a scooter with a speed of 25 km/h. Find the average speed for the whole journey.

(a) 29.16 km/h   (b) 26.19 km/h
(c) 25 km/h   (d) 24.5 km/

Sol. (a) $\therefore$ Average speed $= \dfrac{2ab}{a+b} = \dfrac{2 \times 35 \times 25}{35 + 25}$

$$= 29.16 \text{ km/h}$$

☑ The distance covered by train in passing a pole or a standing man or a signal post or any other object (of negligible length) is equal to the length of the train.

If a train passes an object (bridge, platform etc) having some length then the distance covered by train is equal to the sum of the length of train and that particular object which it is passing.

Example 4 A 270 m long goods train is running at 40.5 km/h. How much time will it take to cross a tree?

(a) 12 s   (b) 15 s   (c) 24 s   (d) 13 s

Sol. (a) Speed of the train = 40.5 km/h

$$= \left(40.5 \times \dfrac{5}{18} \right) \text{m/s} = \dfrac{45}{4} \text{ m/s}$$

Length of the train = 270 m

$\therefore$ Time taken by the train $= \dfrac{\text{Distance}}{\text{Speed}}$

$$= \left(\dfrac{270}{45/2} \right) \text{s} = 12 \text{ s}$$

Example 5 A train is running at 36 km/h. If it crosses a pole in 25 s. Find its length.

(a) 300 m   (b) 240 m   (c) 500 m   (d) 250 m

Sol. (d) Speed $= 36 \text{ km/h} = \left(36 \times \dfrac{5}{18} \right) = 10 \text{ m/s}$

Time taken by the train to cross a pole = 25 s

$\therefore$ Length of the train = (Speed × Time)

$$= (10 \times 25) = 250 \text{ m}$$

Hence, the length of the train is 250 m.

Example 6 How much time will a train, 171 m long, take to cross a bridge, 229 m long. If it is running at a speed of 45 km/h?

(a) 16 s   (b) 32 s   (c) 25 s   (d) 26 s

Sol. (b) Speed of the train = 45 km/h

$$= \left(45 \times \dfrac{5}{18} \right) \text{m/s} = \dfrac{25}{2} \text{ m/s}$$

In order to cross a bridge of length 229 m, the train will have to cross a distance of

$(171 + 229) \text{ m} = 400 \text{ m}.$

$\therefore$ Time taken $= \dfrac{\text{Distance}}{\text{Speed}} = \left(\dfrac{400}{25/2} \right) = 32 \text{ s}$

Important Formula

- To convert speed in m/s from km/h multiply it with $\dfrac{5}{18}$.

- To convert speed in km/h from m/s multiply it with $\dfrac{18}{5}$.

- 1 min = 60 s   ▪ 1 h = 60 min
- 1 day = 24 h   ▪ 1 km = 1000 m

⏰ Practice Exercise

1. The speed of a boat in still water is 5 m/s. What is its speed in km/h?
   (a) 15 km/h   (b) 28 km/h
   (c) 18 km/h   (d) 38 km/h

2. Find the distance covered by a car moving at 20 m/s for 3 h.
   (a) 215 km
   (b) 216 km
   (c) 250 km
   (d) 200 km

3. Find the time taken to cover a distance 0.9 km by a bullock cart moving at 0.25 m/s.
   (a) 6 h   (b) 5 h   (c) 1 h   (d) 2 h

4. A train runs at 45 km/h. How far does it go in 6 s?
   (a) 75 m   (b) 80 m
   (c) 7.5 m   (d) 100 m

5. A train 315 m long is running at 54 km/h. How much time will it takes to cross a pole?
(a) 30 s   (b) 28 s   (c) 25 s   (d) 21 s

6. A train is running at the speed of 42 km/h. If it crosses a pole in 20 s. Find the length of the train.
(a) 250 m
(b) 233.33 m
(c) 220.55 m
(d) 230.33 m

7. Sound travels at the speed of 330 m/s. How many kilometres will it travel in 1 h?
(a) 1080   (b) 1133
(c) 1188   (d) 1180

8. How much farther can an inter-state bus go by travelling at 80 km/h rather than at 75 km/h in 5 h?
(a) 25 km
(b) 30 km
(c) 20 km
(d) 50 km

9. A bullet is fired at a distance of 3.32 km away from Ajay. He hears the sound 10 s later. Find the speed of the sound.
(a) 350 m/s   (b) 400 m/s
(c) 232 m/s   (d) 332 m/s

10. A train 360 m long is running with a speed of 45 km/h. In what time will it pass a bridge 140 m long?
(a) 50 s   (b) 40 s   (c) 30 s   (d) 35 s

11. A train 210 m long took 12 s to pass a 90 m long tunnel. Find the speed of the train in km/h.
(a) 90 km/h   (b) 95 km/h
(c) 75 km/h   (d) 60 km/h

12. A train covers a distance of 200 km with a speed of 10 km/h. What time is taken by the train to cover this distance?
(a) 30 h   (b) 25 h   (c) 20 h   (d) 35 h

Answers

1	(c)	2	(b)	3	(c)	4	(a)	5	(d)	6	(b)	7	(c)	8	(a)	9	(d)	10	(b)
11	(a)	12	(c)																	

Hints & Solutions

1. Speed = 5 m/s = $\left(5 \times \dfrac{18}{5}\right)$ km/h = 18 km/h

2. Speed = 20 m/s
$$= \left(20 \times \dfrac{18}{5}\right) \text{km/h} = 72 \text{ km/h}$$
Time = 3 h
∴ Distance = Speed × Time = 72 × 3 = 216 km

3. Speed = 0.25 m/s
$$= \left(0.25 \times \dfrac{18}{5}\right) \text{km/h} = 0.9 \text{ km/h}$$
and   distance = 0.9 km
∴   Time = $\dfrac{\text{Distance}}{\text{Speed}} = \dfrac{0.9}{0.9} = 1$ h

4. Speed = 45 km/h = $\left(45 \times \dfrac{5}{18}\right)$ m/s = $\dfrac{25}{2}$ m/s
Time = 6 s

∴ Distance = Speed × Time = $\dfrac{25}{2} \times 6 = 75$ m

5. Speed = 54 km/h
$$= \left(54 \times \dfrac{5}{18}\right) \text{m/s} = 15 \text{ m/s}$$
Length of the train = 315 m
∴ Time = $\dfrac{\text{Distance}}{\text{Speed}} = \dfrac{315}{15} = 21$ s

6. Speed = 42 km/h = $\left(42 \times \dfrac{5}{18}\right)$ m/s
$$= \dfrac{35}{3} \text{ m/s}$$
Time taken by train = 20 s
∴ Distance = Speed × Time = $\dfrac{35}{3} \times 20$
$$= 233.33 \text{ m}$$

7. Speed $= 330$ m/s $= \left(330 \times \dfrac{18}{5}\right)$ km/h

$\qquad = (66 \times 18)$ km/h

$\qquad = 1188$ km/h

Sound will travel 1188 km in 1h.

8. When speed was 75 km/h.

Bus covers 75 km in 1 h.

∴ Bus covers (75×5) km, *i.e.,* 375 km in 5 h.

When speed was 80 km/h, bus covers 80 km in 1 h.

∴ Bus covers (80×5) km, *i.e.,* 400 km in 5 h.

Thus, bus is $(400 - 375)$ km $= 25$ km farther.

9. Distance covered $= 3.32$ km

$\qquad = (3.32 \times 1000)$ m

$\qquad = 3320$ m

Time taken $= 10$ s

Now, speed $= \dfrac{\text{Distance}}{\text{Time}} = \dfrac{3320}{10} = 332$ m/s

10. Speed $= 45$ km/h $= \left(45 \times \dfrac{5}{18}\right)$ m/s $= \dfrac{25}{2}$ m/s

In order to cross a bridge of length 140 m, the train will have to cover a distance of $(360 + 140) = 500$ m.

∴ Time taken $= \dfrac{\text{Distance}}{\text{Speed}} = \left(\dfrac{500}{25/2}\right)$

$\qquad = \left(\dfrac{500 \times 2}{25}\right) = 40$ s

11. Total distance covered by the train

$\qquad = (210 + 90) = 300$ m

Time taken by the train $= 12$ s

Speed $= \dfrac{\text{Distance}}{\text{Time}}$

$\qquad = \dfrac{300}{12} = 25$ m/s

$\qquad = 25 \times \dfrac{18}{5} = 90$ km/h

12. ∵ Time $= \dfrac{\text{Distance}}{\text{Speed}}$

∴ Time $= \dfrac{200}{10} = 20$ h

➡ Try Yourself

1) Convert 781 cm/s in m/s.
(a) 6.50 m/s   (b) 8.50 m/s
(c) 7.81 m/s   (d) 7.51 m/s

2) The speed of a bus is 50 km/h. What is its speed in m/s?
(a) 12.89 m/h   (b) 14.89 m/h
(c) 13.89 m/h   (d) 13.50 m/h

3) A man runs 2.5 km in 10 min. Find his speed in km/h.
(a) 17 km/h   (b) 15 km/h
(c) 20 km/h   (d) 14 km/h

4) A man walk 22.5 km in 5 h. How much will he walk in 4 h?
(a) 18 km   (b) 15 km   (c) 19 km   (d) 20 km

5) A car travels at the speed of 72 km/h. How many metres will it travels in 1s?
(a) 19   (b) 25   (c) 21   (d) 20

6) A train 450 m long, crosses a pole in $22\dfrac{1}{2}$ s.
What is the speed of the train in km/h?
(a) 70   (b) 72   (c) 69   (d) 60

7) A train is running at 36 km/h. If it crosses a pole in 25 s, find its length.
(a) 250 m   (b) 225 m
(c) 255 m   (d) 256 m

8) How much time will a train 60 m long, take to cross a bridge 40 m long, if it running at a speed of 20 m/s?
(a) 4 s   (b) 9 s
(c) 8 s   (d) 5 s

9) A car is running at a speed of 65 km/hr. How much time will it take to cover a distance of 260 km?
(a) 4 hr   (b) 4 hr 30 min
(c) 5 hr   (d) 4 hr 40 min

10) A train takes 9 s to cross a pole. If the speed of the train is 48 km/h, then lenght of the train is
(a) 150 m   (b) 120 m
(c) 90 m   (d) 80 m

Answers

1	*(c)*	2	*(c)*	3	*(b)*	4	*(a)*	5	*(d)*
6	*(b)*	7	*(a)*	8	*(d)*	9	*(a)*	10	*(b)*