



**SNS COLLEGE OF TECHNOLOGY**  
**An Autonomous Institution**  
**Coimbatore-35**



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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**19GET276 – VQAR II**

II YEAR/ IV SEMESTER

**UNIT 1 – QUANTITATIVE ABILITY III**

**TOPIC – AVERAGE SPEED, RELATIVE SPEED, TRAINS**

AVERAGE & RELATIVE SPEED, TRAINS/19GET276 – VQAR II/S.SHARMILA/EEE/SNSCT





## TRAINS



. Time taken by a train of length  $l$  metres to pass a pole or standing man or a signal post is equal to the time taken by the train to cover  $l$  metres.

. Time taken by a train of length  $l$  metres to pass a stationary object of length  $b$  metres is the time taken by the train to cover  $(l + b)$  metres.

. Suppose two trains or two objects bodies are moving in the same direction at  $u$  m/s and  $v$  m/s, where  $u > v$ , then their relative speed is  $= (u - v)$  m/s.

. Suppose two trains or two objects bodies are moving in opposite directions at  $u$  m/s and  $v$  m/s, then their relative speed is  $= (u + v)$  m/s.

. If two trains of length  $a$  metres and  $b$  metres are moving in opposite directions at  $u$  m/s and  $v$  m/s, then:

The time taken by the trains to cross each other  $= \frac{(a + b)}{(u + v)}$  sec.

. If two trains of length  $a$  metres and  $b$  metres are moving in the same direction at  $u$  m/s and  $v$  m/s, then:

The time taken by the faster train to cross the slower train  $= \frac{(a + b)}{(u - v)}$  sec.





## TRAINS



1. A train running at the speed of 60 km/hr crosses a pole in 9 seconds. What is the length of the train?
- A. 120 metres
  - B. 180 metres
  - C. 324 metres
  - D. 150 metres

**Answer:** Option D

**Explanation:**

$$\text{Speed} = \left(60 \times \frac{5}{18}\right) \text{m/sec} = \left(\frac{50}{3}\right) \text{m/sec.}$$

Length of the train = (Speed x Time).

$$\therefore \text{Length of the train} = \left(\frac{50}{3} \times 9\right) \text{m} = 150 \text{ m.}$$





## TRAINS



2. A train 125 m long passes a man, running at 5 km/hr in the same direction in which the train is going, in 10 seconds. The speed of the train is:

- A. 45 km/hr
- B. 50 km/hr
- C. 54 km/hr
- D. 55 km/hr

**Answer:** Option B

**Explanation:**

$$\text{Speed of the train relative to man} = \left( \frac{125}{10} \right) \text{m/sec}$$

$$= \left( \frac{25}{2} \right) \text{m/sec.}$$

$$= \left( \frac{25}{2} \times \frac{18}{5} \right) \text{km/hr}$$

$$= 45 \text{ km/hr.}$$

Let the speed of the train be  $x$  km/hr. Then, relative speed =  $(x - 5)$  km/hr.

$$\therefore x - 5 = 45 \Rightarrow x = 50 \text{ km/hr.}$$





## TRAINS



3. The length of the bridge, which a train 130 metres long and travelling at 45 km/hr can cross in 30 seconds, is:
- A. 200 m
  - B. 225 m
  - C. 245 m
  - D. 250 m

**Answer:** Option C

**Explanation:**

$$\text{Speed} = \left( 45 \times \frac{5}{18} \right) \text{m/sec} = \left( \frac{25}{2} \right) \text{m/sec.}$$

Time = 30 sec.

Let the length of bridge be  $x$  metres.

$$\text{Then, } \frac{130 + x}{30} = \frac{25}{2}$$

$$\Rightarrow 2(130 + x) = 750$$

$$\Rightarrow x = 245 \text{ m.}$$





## TRAINS



4. Two trains running in opposite directions cross a man standing on the platform in 27 seconds and 17 seconds respectively and they cross each other in 23 seconds. The ratio of their speeds is:
- A. 1 : 3
  - B. 3 : 2
  - C. 3 : 4
  - D. None of these

**Answer:** Option **B**

**Explanation:**

Let the speeds of the two trains be  $x$  m/sec and  $y$  m/sec respectively.

Then, length of the first train =  $27x$  metres,

and length of the second train =  $17y$  metres.

$$\therefore \frac{27x + 17y}{x + y} = 23$$

$$\Rightarrow 27x + 17y = 23x + 23y$$

$$\Rightarrow 4x = 6y$$

$$\Rightarrow \frac{x}{y} = \frac{3}{2}$$





## TRAINS



5. A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is 54 km/hr, what is the length of the platform?
- A. 120 m
  - B. 240 m
  - C. 300 m
  - D. None of these

**Answer:** Option B

**Explanation:**

$$\text{Speed} = \left( 54 \times \frac{5}{18} \right) \text{m/sec} = 15 \text{ m/sec.}$$

$$\text{Length of the train} = (15 \times 20)\text{m} = 300 \text{ m.}$$

Let the length of the platform be  $x$  metres.

$$\text{Then, } \frac{x + 300}{36} = 15$$

$$\Rightarrow x + 300 = 540$$

$$\Rightarrow x = 240 \text{ m.}$$







## TRAINS



6. A train 240 m long passes a pole in 24 seconds. How long will it take to pass a platform 650 m long?
- A. 65 sec
  - B. 89 sec
  - C. 100 sec
  - D. 150 sec

**Answer:** Option **B**

**Explanation:**

$$\text{Speed} = \left( \frac{240}{24} \right) \text{m/sec} = 10 \text{ m/sec.}$$

$$\therefore \text{Required time} = \left( \frac{240 + 650}{10} \right) \text{sec} = 89 \text{ sec.}$$







## TRAINS



7. Two trains of equal length are running on parallel lines in the same direction at 46 km/hr and 36 km/hr. The faster train passes the slower train in 36 seconds. The length of each train is:
- A. 50 m
  - B. 72 m
  - C. 80 m
  - D. 82 m

**Answer:** Option A

**Explanation:**

Let the length of each train be  $x$  metres.

Then, distance covered =  $2x$  metres.

Relative speed =  $(46 - 36)$  km/hr

$$= \left( 10 \times \frac{5}{18} \right) \text{m/sec}$$

$$= \left( \frac{25}{9} \right) \text{m/sec}$$

$$\therefore \frac{2x}{36} = \frac{25}{9}$$

$$\Rightarrow 2x = 100$$

$$\Rightarrow x = 50.$$





## TRAINS



8. A train 360 m long is running at a speed of 45 km/hr. In what time will it pass a bridge 140 m long?
- A. 40 sec
  - B. 42 sec
  - C. 45 sec
  - D. 48 sec

**Answer:** Option A

**Explanation:**

**Formula for converting from km/hr to m/s:**  $X \text{ km/hr} = \left( X \times \frac{5}{18} \right) \text{ m/s.}$

Therefore, Speed =  $\left( 45 \times \frac{5}{18} \right) \text{ m/sec} = \frac{25}{2} \text{ m/sec.}$

Total distance to be covered =  $(360 + 140) \text{ m} = 500 \text{ m.}$

**Formula for finding Time** =  $\left( \frac{\text{Distance}}{\text{Speed}} \right)$

$\therefore$  Required time =  $\left( \frac{500 \times 2}{25} \right) \text{ sec} = 40 \text{ sec.}$





## TRAINS



9. Two trains are moving in opposite directions @ 60 km/hr and 90 km/hr. 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. 36
  - B. 45
  - C. 48
  - D. 49

**Answer:** Option C

**Explanation:**

Relative speed = (60+ 90) km/hr

$$= \left( 150 \times \frac{5}{18} \right) \text{m/sec}$$

$$= \left( \frac{125}{3} \right) \text{m/sec.}$$

Distance covered = (1.10 + 0.9) km = 2 km = 2000 m.

$$\text{Required time} = \left( 2000 \times \frac{3}{125} \right) \text{sec} = 48 \text{ sec.}$$





## TRAINS



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

- A. 3.6 sec
- B. 18 sec
- C. 36 sec
- D. 72 sec

**Answer:** Option C

**Explanation:**

Speed of train relative to jogger =  $(45 - 9)$  km/hr = 36 km/hr.

$$= \left( 36 \times \frac{5}{18} \right) \text{m/sec}$$
$$= 10 \text{ m/sec.}$$

Distance to be covered =  $(240 + 120)$  m = 360 m.

$$\therefore \text{Time taken} = \left( \frac{360}{10} \right) \text{sec} = 36 \text{ sec.}$$





## TRAINS



11. A 270 metres long train running at the speed of 120 kmph crosses another train running in opposite direction at the speed of 80 kmph in 9 seconds. What is the length of the other train?
- A. 230 m
  - B. 240 m
  - C. 260 m
  - D. 320 m
  - E. None of these

**Answer:** Option A

**Explanation:**

Relative speed =  $(120 + 80)$  km/hr

$$= \left( 200 \times \frac{5}{18} \right) \text{m/sec}$$

$$= \left( \frac{500}{9} \right) \text{m/sec.}$$

Let the length of the other train be  $x$  metres.

$$\text{Then, } \frac{x + 270}{9} = \frac{500}{9}$$

$$\Rightarrow x + 270 = 500$$

$$\Rightarrow x = 230.$$





## TRAINS



12. 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

**Answer:** Option **D**

**Explanation:**

$$\text{Speed} = \left( 72 \times \frac{5}{18} \right) \text{m/sec} = 20 \text{ m/sec.}$$

Time = 26 sec.

Let the length of the train be  $x$  metres.

$$\text{Then, } \frac{x + 250}{26} = 20$$

$$\Rightarrow x + 250 = 520$$

$$\Rightarrow x = 270.$$





## TRAINS



13. Two trains, each 100 m long, moving in opposite directions, cross each other in 8 seconds. If one is moving twice as fast the other, then the speed of the faster train is:

- A. 30 km/hr
- B. 45 km/hr
- C. 60 km/hr
- D. 75 km/hr

**Answer:** Option C

**Explanation:**

Let the speed of the slower train be  $x$  m/sec.

Then, speed of the faster train =  $2x$  m/sec.

Relative speed =  $(x + 2x)$  m/sec =  $3x$  m/sec.

$$\therefore \frac{(100 + 100)}{8} = 3x$$

$$\Rightarrow 24x = 200$$

$$\Rightarrow x = \frac{25}{3}$$

So, speed of the faster train =  $\frac{50}{3}$  m/sec

$$= \left( \frac{50}{3} \times \frac{18}{5} \right) \text{ km/hr}$$

$$= 60 \text{ km/hr.}$$







## TRAINS



14. Two trains 140 m and 160 m long run at the speed of 60 km/hr and 40 km/hr respectively in opposite directions on parallel tracks. The time (in seconds) which they take to cross each other, is:

- A. 9
- B. 9.6
- C. 10
- D. 10.8

**Answer:** Option **D**

**Explanation:**

$$\text{Relative speed} = (60 + 40) \text{ km/hr} = \left(100 \times \frac{5}{18}\right) \text{ m/sec} = \left(\frac{250}{9}\right) \text{ m/sec.}$$

Distance covered in crossing each other =  $(140 + 160) \text{ m} = 300 \text{ m.}$

$$\text{Required time} = \left(300 \times \frac{9}{250}\right) \text{ sec} = \frac{54}{5} \text{ sec} = 10.8 \text{ sec.}$$





## TRAINS



15. A train 110 metres long is running with a speed of 60 kmph. In what time will it pass a man who is running at 6 kmph in the direction opposite to that in which the train is going?
- A. 5 sec
  - B. 6 sec
  - C. 7 sec
  - D. 10 sec

**Answer:** Option **B**

**Explanation:**

Speed of train relative to man =  $(60 + 6)$  km/hr = 66 km/hr.

$$= \left( 66 \times \frac{5}{18} \right) \text{m/sec}$$

$$= \left( \frac{55}{3} \right) \text{m/sec.}$$

$$\therefore \text{Time taken to pass the man} = \left( 110 \times \frac{3}{55} \right) \text{sec} = 6 \text{ sec.}$$





**THANK YOU**

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