



# **SNS COLLEGE OF TECHNOLOGY**

## **An Autonomous Institution**

### **Coimbatore-35**



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF CIVIL ENGINEERING**

### **23GET276 – VQAR II**

II YEAR/ IV SEMESTER

### **UNIT 1 – QUANTITATIVE ABILITY III**

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



# 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 stationery 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:**

Speed of the train relative to man =  $\left(\frac{125}{10}\right)$  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 is 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 =  $(45 - 9) \text{ km/hr} = 36 \text{ km/hr}$ .

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

Distance to be covered =  $(240 + 120) \text{ m} = 360 \text{ m}$ .

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



# 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.

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

$$\Rightarrow 24x = 200$$

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

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

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

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



# 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:**

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

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

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



# 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