18. PROBLEMS ON TRAINS

IMPORTANT FACTS AND FORMULAE

1. a km/hr $= \left(a \times \frac{5}{18}\right)$ m/s.
2. a m/s $= \left(a \times \frac{18}{5}\right)$ km/hr.
3. Time taken by a train of length l metres to pass a pole or a standing man or a signal post is equal to the time taken by the train to cover l metres.
4. 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.
5. Suppose two trains or two bodies are moving in the same direction at u m/s and v m/s, where $u > v$, then their relatives speed $= (u - v)$ m/s.
6. Suppose two trains or two bodies are moving in opposite directions at u m/s and v m/s, then their relative speed is $= (u + v)$ m/s.
7. If two trains of length a metres and b metres are moving in opposite directions at u m/s and v m/s, then time taken by the trains to cross each other $= \frac{(a + b)}{(u + v)}$ sec.
8. 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.
9. If two trains (or bodies) start at the same time from points A and B towards each other and after crossing they take a and b sec in reaching B and A respectively, then *(A's speed)* : *(B's speed)* $= (\sqrt{b} : \sqrt{a})$.

SOLVED EXAMPLES

Ex. 1. ***A train 100 m long is running at the speed of 30 km/hr. Find the time taken by it to pass a man standing near the railway line.*** (S.S.C. 2001)

Sol. Speed of the train $= \left(30 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{25}{3}\right)$ m/sec.

Distance moved in passing the standing man = 100 m.

Required time taken $= \frac{100}{\left(\frac{25}{3}\right)} = \left(100 \times \frac{3}{25}\right)$ sec = 12 sec.

Ex. 2. ***A train is moving at a speed of 132 km/hr. If the length of the train is 110 metres, how long will it take to cross a railway platform 165 metres long?*** (Section Officers', 2003)

Sol. Speed of train $= \left(132 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{110}{3}\right)$ m/sec.

Distance covered in passing the platform = (110 + 165) m = 275 m.

$\therefore$ Time taken $= \left(275 \times \frac{3}{110}\right)$ sec $= \frac{15}{2}$ sec $= 7\frac{1}{2}$ sec.

Ex. 3. ***A man is standing on a railway bridge which is 180 m long. He finds that a train crosses the bridge in 20 seconds but himself in 8 seconds. Find the length of the train and its speed.***

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

Then, the train covers x metres in 8 seconds and $(x + 180)$ metres in 20 seconds.

$\therefore \quad \frac{x}{8} = \frac{x+180}{20} \Leftrightarrow 20x = 8(x+180) \Leftrightarrow x = 120.$

$\therefore$ Length of the train = 120 m.

Speed of the train $= \left(\frac{120}{8}\right)$ m/sec = m/sec $= \left(15 \times \frac{18}{5}\right)$ kmph = 54 kmph.

Ex. 4. ***A train 150 m long is running with a speed of 68 kmph. In what time will it pass a man who is running at 8 kmph in the same direction in which the train is going ?***

Sol. Speed of the train relative to man = (68 − 8) kmph

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

Time taken by the train to cross the man

= Time taken by it to cover 150 m at $\left(\frac{50}{3}\right)$ m/sec $= \left(150 \times \frac{3}{50}\right)$ sec = 9 sec.

Ex. 5. ***A train 220 m long is running with a speed of 59 kmph. In what time will it pass a man who is running at 7 kmph in the direction opposite to that in which the train is going ?***

Sol. Speed of the train relative to man = (59 + 7) kmph

$= \left(66 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{55}{3}\right)$ m/sec.

Time taken by the train to cross the man

= Time taken by it to cover 220 m at $\left(\frac{55}{3}\right)$ m/sec $= \left(220 \times \frac{3}{55}\right)$ sec = 12 sec.

Ex. 6. ***Two trains 137 metres and 163 metres in length are running towards each other on parallel lines, one at the rate of 42 kmph and another at 48 kmph. In what time will they be clear of each other from the moment they meet ?***

Sol. Relative speed of the trains = (42 + 48) kmph = 90 kmph

$= \left(90 \times \frac{5}{18}\right)$ m/sec = 25 m/sec.

Time taken by the trains to pass each other

= Time taken to cover (137 + 163) m at 25 m/sec $= \left(\frac{300}{25}\right)$ sec = 12 seconds.

Ex. 7. ***Two trains 100 metres and 120 metres long are running in the same direction with speeds of 72 km/hr and 54 km/hr. In how much time will the first train cross the second ?*** (C.B.I. 1997)

Sol. Relative speed of the trains = (72 − 54) km/hr = 18 km/hr

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

Ex. 8. ***A train 100 metres long takes 6 seconds to cross a man walking at 5 kmph in a direction opposite to that of the train. Find the speed of the train.***

Sol. Let the speed of the train be x kmph.

Speed of the train relative to man $= (x + 5)$ kmph $= (x+5)\times\frac{5}{18}$ m/sec.

$\therefore \quad \frac{100}{(x+5)\times\frac{5}{18}} = 6 \Leftrightarrow 30(x+5) = 1800 \Leftrightarrow x = 55.$

$\therefore$ Speed of the train is 55 kmph.

Ex. 9. ***A train running at 54 kmph takes 20 seconds to pass a platform. Next it takes 12 seconds to pass a man walking at 6 kmph in the same direction in which the train is going. Find the length of the train and the length of the platform.***

Sol. Let the length of train be x metres and length of platform be y metres.

Speed of the train relative to man $= (54 - 6)$ kmph $= 48$ kmph

$$= \left(48\times\frac{5}{18}\right) \text{m/sec} = \frac{40}{3} \text{m/sec}.$$

In passing a man, the train covers its own length with relative speed.

$\therefore$ Length of train = (Relative speed $\times$ Time) $= \left(\frac{40}{3}\times 12\right)$ m $= 160$ m.

Also, speed of the train $= \left(54\times\frac{5}{18}\right)$ m/sec $= 15$ m/sec.

$\therefore \quad \frac{x+y}{15} = 20 \Leftrightarrow x + y = 300 \Leftrightarrow y = (300 - 160)$ m $= 140$ m.

Ex. 10. ***A man sitting in a train which is travelling at 50 kmph observes that a goods train, travelling in opposite direction, takes 9 seconds to pass him. If the goods train is 280 m long, find its speed.***

Sol. Relative speed $= \left(\frac{280}{9}\right)$ m/sec $= \left(\frac{280}{9}\times\frac{18}{5}\right)$ kmph $= 112$ kmph.

$\therefore$ Speed of goods train $= (112 - 50)$ kmph $= 62$ kmph.

EXERCISE 18A

(OBJECTIVE TYPE QUESTIONS)

Directions : ***Mark (✓) against the correct answer :***

1. A train moves with a speed of 108 kmph. Its speed in metres per second is :
   (a) 10.8 (b) 18 (c) 30 (d) 38.8
2. A speed of 14 metres per second is the same as :
   (a) 28 km/hr (b) 46.6 km/hr (c) 50.4 km/hr (d) 70 km/hr
3. In what time will a train 100 metres long cross an electric pole, if its speed be 144 km/hr ? **(S.S.C. 2003)**
   (a) 2.5 seconds (b) 4.25 seconds (c) 5 seconds (d) 12.5 seconds
4. A train 280 m long, running with a speed of 63 km/hr will pass a tree in :
   (a) 15 sec (b) 16 sec (c) 18 sec (d) 20 sec **(S.S.C. 2003)**
5. How long does a train 110 metres long running at the speed of 72 km/hr take to cross a bridge 132 metres in length ? **(R.R.B. 1998)**
   (a) 9.8 sec (b) 12.1 sec (c) 12.42 sec (d) 14.3 sec

6. 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 ? **(B.S.F. 2001)**
(*a*) 40 sec (*b*) 42 sec (*c*) 45 sec (*d*) 48 sec

7. A train travelling at a speed of 75 mph enters a tunnel $3\frac{1}{2}$ miles long. The train is $\frac{1}{4}$ mile long. How long does it take for the train to pass through the tunnel from the moment the front enters to the moment the rear emerges ?
(*a*) 2.5 min (*b*) 3 min (*c*) 3.2 min (*d*) 3.5 min

8. A train running at the speed of 60 km / hr crosses a pole in 9 seconds. What is the length of the train ? **(Bank P.O. 2003)**
(*a*) 120 metres (*b*) 180 metres (*c*) 324 metres
(*d*) Cannot be determined (*e*) None of these

9. A train 132 m long passes a telegraph pole in 6 seconds. Find the speed of the train.
(*a*) 70 km / hr (*b*) 72 km / hr (*c*) 79.2 km / hr (*d*) 80 km / hr

10. A train covers a distance of 12 km in 10 minutes. If it takes 6 seconds to pass a telegraph post, then the length of the train is : **(Bank P.O. 2000)**
(*a*) 90 m (*b*) 100 m (*c*) 120 m (*d*) 140 m

11. A train 240 m long passed a pole in 24 seconds. How long will it take to pass a platform 650 m long ? **(R.R.B. 1998)**
(*a*) 65 sec (*b*) 89 sec (*c*) 100 sec (*d*) 150 sec

12. The length of the bridge, which a train 130 metres long and travelling at 45 km / hr can cross in 30 seconds, is : **(Section Officers', 2001)**
(*a*) 200 m (*b*) 225 m (*c*) 245 m (*d*) 250 m

13. A train 800 metres long is running at a speed of 78 km / hr. If it crosses a tunnel in 1 minute, then the length of the tunnel (in metres) is : **(S.S.C. 2003)**
(*a*) 130 (*b*) 360 (*c*) 500 (*d*) 540

14. 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 ? **(Bank P.O. 2003)**
(*a*) 230 m (*b*) 240 m (*c*) 260 m (*d*) 270 m

15. The length of a train and that of a platform are equal. If with a speed of 90 km / hr, the train crosses the platform in one minute, then the length of the train (in metres) is :
(*a*) 500 (*b*) 600 (*c*) 750 (*d*) 900

16. A train of length 150 metres takes 40.5 seconds to cross a tunnel of length 300 metres. What is the speed of the train in km / hr ?
(*a*) 13.33 (*b*) 26.67 (*c*) 40 (*d*) 66.67

17. A train crosses a platform 100 m long in 60 seconds at a speed of 45 km / hr. The time taken by the train to cross an electric pole is :
(*a*) 8 sec (*b*) 52 sec (*c*) 1 minute (*d*) Data inadequate

18. 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 ? **(G.INDOMAT, 1997)**
(*a*) 120 m (*b*) 240 m (*c*) 300 m (*d*) None of these

19. A 300 metre long train crosses a platform in 39 seconds while it crosses a signal pole in 18 seconds. What is the length of the platform ?
(*a*) 320 m (*b*) 350 m (*c*) 650 m
(*d*) Data inadequate (*e*) None of these **(Bank P.O. 2002)**

20. A train speeds past a pole in 15 seconds and a platform 100 m long in 25 seconds. Its length is : **(R.R.B. 2003)**
(*a*) 50 m (*b*) 150 m (*c*) 200 m (*d*) Data inadequate

21. A train moves past a telegraph post and a bridge 264 m long in 8 seconds and 20 seconds respectively. What is the speed of the train ? **(S.S.C. 2004)**
(*a*) 69.5 km / hr (*b*) 70 km / hr (*c*) 79 km / hr (*d*) 79.2 km / hr

22. A train takes 18 seconds to pass completely through a station 162 m long and 15 seconds through another station 120 m long. The length of the train is :
(*a*) 70 m (*b*) 80 m (*c*) 90 m (*d*) 100 m

23. How many seconds will a 500 metre long train take to cross a man walking with a speed of 3 km / hr in the direction of the moving train if the speed of the train is 63 km / hr ? **(S.S.C. 2000)**
(*a*) 25 (*b*) 30 (*c*) 40 (*d*) 45

24. A jogger running at 9 kmph alongside a railway track is 240 metres ahead of the engine of a 120 metre long train running at 45 kmph in the same direction. In how much time will the train pass the jogger ? **(IGNOU, 2003)**
(*a*) 3.6 sec (*b*) 18 sec (*c*) 36 sec (*d*) 72 sec

25. 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 ? **(M.A.T. 2002)**
(*a*) 5 sec (*b*) 6 sec (*c*) 7 sec (*d*) 10 sec

26. Two trains 200 m and 150 m long are running on parallel rails at the rate of 40 kmph and 45 kmph respectively. In how much time will they cross each other, if they are running in the same direction ?
(*a*) 72 sec (*b*) 132 sec (*c*) 192 sec (*d*) 252 sec

27. 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 : **(S.S.C. 2004)**
(*a*) 9 (*b*) 9.6 (*c*) 10 (*d*) 10.8

28. 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 : **(M.B.A. 2002)**
(*a*) 36 (*b*) 45 (*c*) 48 (*d*) 49

29. 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.A.O. Exam, 2003)**
(*a*) 45 km / hr (*b*) 50 km / hr (*c*) 54 km / hr (*d*) 55 km / hr

30. A train 110 m long passes a man, running at 6 kmph in the direction opposite to that of the train, in 6 seconds. The speed of the train is :
(*a*) 54 km / hr (*b*) 60 km / hr (*c*) 66 km / hr (*d*) 72 km / hr

31. Two goods train each 500 m long, are running in opposite directions on parallel tracks. Their speeds are 45 km / hr and 30 km / hr respectively. Find the time taken by the slower train to pass the driver of the faster one. **(M.A.T. 2000)**
(*a*) 12 sec (*b*) 24 sec (*c*) 48 sec (*d*) 60 sec

32. 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 : **(M.A.T. 2003)**
(*a*) 50 m (*b*) 72 m (*c*) 80 m (*d*) 82 m

33. 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 ? **(S.B.I.P.O. 1999)**
(*a*) 230 m (*b*) 240 m (*c*) 260 m
(*d*) 320 m (*e*) None of these

34. Two trains are running in opposite directions with the same speed. If the length of each train is 120 metres and they cross each other in 12 seconds, then the speed of each train (in km / hr) is : **(S.S.C. 2003)**
(*a*) 10 (*b*) 18 (*c*) 36 (*d*) 72

35. Two trains of equal lengths take 10 seconds and 15 seconds respectively to cross a telegraph post. If the length of each train be 120 metres, in what time (in seconds) will they cross each other travelling in opposite direction ? **(S.S.C. 2004)**
(a) 10 (b) 12 (c) 15 (d) 20

36. A train 108 m long moving at a speed of 50 km / hr crosses a train 112 m long coming from opposite direction in 6 seconds. The speed of the second train is
(a) 48 km / hr (b) 54 km / hr (c) 66 km / hr (d) 82 km / hr

37. A train X speeding with 120 kmph crosses another train Y, running in the same direction, in 2 minutes. If the lengths of the trains X and Y be 100 m and 200 m respectively, what is the speed of train Y ?
(a) 111 km / hr (b) 123 km / hr (c) 127 km / hr (d) 129 km / hr

38. Two trains travel in opposite directions at 36 kmph and 45 kmph and a man sitting in slower train passes the faster train in 8 seconds. The length of the faster train is :
(a) 80 m (b) 100 m (c) 120 m (d) 180 m

39. Two trains are running at 40 km / hr and 20 km / hr respectively in the same direction. Fast train completely passes a man sitting in the slower train in 5 seconds. What is the length of the fast train ? **(R.R.B. 2001)**
(a) 23 m (b) $23\frac{2}{9}$ m (c) 27 m (d) $27\frac{7}{9}$ m

40. A train overtakes two persons who are walking in the same direction in which the train is going, at the rate of 2 kmph and 4 kmph and passes them completely in 9 and 10 seconds respectively. The length of the train is :
(a) 45 m (b) 50 m (c) 54 m (d) 72 m

41. A train overtakes two persons walking along a railway track. The first one walks at 4.5 km / hr. The other one walks at 5.4 km / hr. 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 / hr (b) 72 km / hr (c) 78 km / hr (d) 81 km / hr

42. 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 **(C.D.S. 2001)**

43. A train 150 m long passes a km stone in 15 seconds and another train of the same length travelling in opposite direction in 8 seconds. The speed of the second train is :
(a) 60 km / hr (b) 66 km / hr (c) 72 km / hr (d) 99 km / hr

44. A train travelling at 48 kmph completely crosses another train having half its length and travelling in opposite direction at 42 kmph, in 12 seconds. It also passes a railway platform in 45 seconds. The length of the platform is
(a) 400 m (b) 450 m (c) 560 m (d) 600 m

45. 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 : **(Hotel Management, 1997)**
(a) 1 : 3 (b) 3 : 2 (c) 3 : 4 (d) None of these

46. Two stations A and B are 110 km apart on a straight line. One train starts from A at 7 a.m. and travels towards B at 20 kmph. Another train starts from B at 8 a.m. and travels towards A at a speed of 25 kmph. At what time will they meet ?
(a) 9 a.m. (b) 10 a.m. (c) 10.30 a.m. (d) 11 a.m.

47. A train X starts from Meerut at 4 p.m. and reaches Ghaziabad at 5 p.m. while another train Y starts from Ghaziabad at 4 p.m. and reaches Meerut at 5.30 p.m. The two trains will cross each other at :
(a) 4.36 p.m. (b) 4.42 p.m. (c) 4.48 p.m. (d) 4.50 p.m.

48. Two trains, one from Howrah to Patna and the other from Patna to Howrah, start simultaneously. After they meet, the trains reach their destinations after 9 hours and 16 hours respectively. The ratio of their speeds is : **(R.R.B. 2001)**

(a) 2 : 3 (b) 4 : 3 (c) 6 : 7 (d) 9 : 16

ANSWERS

1. (c)	2. (c)	3. (a)	4. (b)	5. (b)	6. (a)	7. (b)	8. (e)
9. (c)	10. (c)	11. (b)	12. (c)	13. (c)	14. (d)	15. (c)	16. (c)
17. (b)	18. (b)	19. (b)	20. (b)	21. (d)	22. (c)	23. (b)	24. (c)
25. (b)	26. (d)	27. (d)	28. (c)	29. (b)	30. (b)	31. (c)	32. (a)
33. (a)	34. (c)	35. (b)	36. (d)	37. (a)	38. (d)	39. (d)	40. (b)
41. (d)	42. (c)	43. (d)	44. (a)	45. (b)	46. (b)	47. (a)	48. (b)

SOLUTIONS

1. 108 kmph $= \left(108 \times \frac{5}{18}\right)$ m/sec $= 30$ m/sec.

2. 14 m/sec $= \left(14 \times \frac{18}{5}\right)$ km/hr $= 50.4$ km/hr.

3. Speed $= \left(144 \times \frac{5}{18}\right)$ m/sec $= 40$ m/sec.

   Time taken $= \left(\frac{100}{40}\right)$ sec $= 2.5$ sec.

4. Speed $= \left(63 \times \frac{5}{18}\right)$ m/sec $= \frac{35}{2}$ m/sec.

   Time taken $= \left(280 \times \frac{2}{35}\right)$ sec $= 16$ sec.

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

   Total distance covered $= (110 + 132)$ m $= 242$ m.

   $\therefore$ Required time $= \left(\frac{242}{20}\right)$ sec $= 12.1$ sec.

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

   Total distance covered $= (360 + 140)$ m $= 500$ m.

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

7. Total distance covered $= \left(\frac{7}{2} + \frac{1}{4}\right)$ miles $= \frac{15}{4}$ miles.

   $\therefore$ Time taken $= \left(\frac{15}{4 \times 75}\right)$ hrs $= \frac{1}{20}$ hrs $= \left(\frac{1}{20} \times 60\right)$ min. $= 3$ min.

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

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

Let the length of the platform be x metres.

Then, $\frac{x+300}{36} = 15 \Leftrightarrow x + 300 = 540 \Leftrightarrow x = 240$ m.

19. Speed $= \left(\frac{300}{18}\right)$ m/sec $= \frac{50}{3}$ m/sec.

Let the length of the platform be x metres.

Then, $\frac{x+300}{39} = \frac{50}{3} \Leftrightarrow 3(x+300) = 1950 \Leftrightarrow x = 350$ m.

20. Let the length of the train be x metres and its speed be y m/sec.

They, $\frac{x}{y} = 15 \Rightarrow y = \frac{x}{15}$.

$\therefore \quad \frac{x+100}{25} = \frac{x}{15} \Leftrightarrow x = 150$ m.

21. Let the length of the train be x metres and its speed by y m/sec.

They, $\frac{x}{y} = 8 \Rightarrow x = 8y$

Now, $\frac{x+264}{20} = y \Leftrightarrow 8y + 264 = 20y \Leftrightarrow y = 22$

$\therefore$ Speed $= 22$ m/sec $= \left(22 \times \frac{18}{5}\right)$ km/hr $= 79.2$ km/hr.

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

$\therefore \quad \frac{x+162}{18} = \frac{x+120}{15} \Leftrightarrow 15(x+162) = 18(x+120) \Leftrightarrow x = 90$ m.

23. Speed of train relative to man $= (63 - 3)$ km/hr $= 60$ km/hr

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

$\therefore$ Time taken to pass the man $= \left(500 \times \frac{3}{50}\right)$ sec $= 30$ sec.

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

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

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

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

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

$= \left(66 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{55}{3}\right)$ m/sec.

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

26. Relative speed $= (45 - 40)$ kmph $= 5$ kmph $= \left(5 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{25}{18}\right)$ m/sec.

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

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

9. Speed $= \left(\frac{132}{6}\right)$ m/sec $= \left(22 \times \frac{18}{5}\right)$ km/hr = 79.2 km/hr.

10. Speed $= \left(\frac{12}{10} \times 60\right)$ km/hr $= \left(72 \times \frac{5}{18}\right)$ m/sec = 20 m/sec.

Length of the train = (Speed × Time) = (20 × 6) m = 120 m.

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

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

12. Speed $= \left(45 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{25}{2}\right)$ m/sec; Time = 30 sec.

Let the length of bridge be x metres.

Then, $\frac{130 + x}{30} = \frac{25}{2} \Leftrightarrow 2(130 + x) = 750 \Leftrightarrow x = 245$ m.

13. Speed $= \left(78 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{65}{3}\right)$ m/sec.

Time = 1 minute = 60 sec.

Let the length of the tunnel be x metres.

Then, $\frac{800 + x}{60} = \frac{65}{3} \Leftrightarrow 3(800 + x) = 3900 \Leftrightarrow x = 500$.

14. Speed $= \left(72 \times \frac{5}{18}\right)$ m/sec = 20 m/sec; Time = 26 sec.

Let the length of the train be x metres.

Then, $\frac{x + 250}{26} = 20 \Leftrightarrow x + 250 = 520 \Leftrightarrow x = 270$.

15. Speed $= \left(90 \times \frac{5}{18}\right)$ m/sec = 25 m/sec; Time = 1 min. = 60 sec.

Let the length of the train and that of the platform be x metres.

Then, $\frac{2x}{60} = 25 \Leftrightarrow x = \frac{25 \times 60}{2} = 750$.

16. Speed $= \left(\frac{150 + 300}{40.5}\right)$ m/sec $= \left(\frac{450}{40.5} \times \frac{18}{5}\right)$ km/hr = 40 km/hr.

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

Let the length of the train be x metres.

Then, $\frac{x + 100}{\left(\frac{25}{2}\right)} = 60$ or $x = 650$ m

$\therefore$ Time taken by the train to cross an electric pole $= \left(650 \times \frac{2}{25}\right)$ sec = 52 sec.

Total distance covered = Sum of lengths of trains = 350 m.

$\therefore$ Time taken $= \left(350 \times \frac{18}{25}\right)$ sec $= 252$ sec.

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

Distance covered in crossing each other $= (140 + 160)$ m $= 300$ m

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

28. Relative speed $= (60 + 90)$ km/hr

$= \left(150 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{125}{3}\right)$ m/sec.

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

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

29. Speed of the train relative to man $= \left(\frac{125}{10}\right)$ m/sec $= \left(\frac{25}{2}\right)$ m/sec.

$= \left(\frac{25}{2} \times \frac{18}{5}\right)$ km/hr $= 45$ km/hr.

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

$\therefore \quad x - 5 = 45 \quad$ or $\quad x = 50$ kmph.

30. Speed of the train relative to man

$= \left(\frac{110}{6}\right)$ m/sec $= \left(\frac{110}{6} \times \frac{18}{5}\right)$ km/hr $= 66$ km/hr.

Let the speed of the train be x kmph. Then, relative speed $= (x + 6) =$ kmph.

$\therefore \quad x + 6 = 66 \quad$ or $\quad x = 60$ kmph.

31. Relative speed $= (45 + 30)$ km/hr $= \left(75 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{125}{6}\right)$ m/sec.

Distance covered $= (500 + 500)$ m $= 1000$ m.

Required time $= \left(1000 \times \frac{6}{125}\right)$ sec $= 48$ sec.

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

Then, distance covered $= 2x$ metres.

Relative speed $= (46 - 36)$ km/hr $= \left(10 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{25}{9}\right)$ m/sec.

$\therefore \quad \frac{2x}{36} = \frac{25}{9} \Leftrightarrow 2x = 100 \Leftrightarrow x = 50.$

33. Relative speed $= (120 + 80)$ km/hr $= \left(200 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{500}{9}\right)$ m/sec.

Let the length of the other train be x metres.

Then, $\frac{x + 270}{9} = \frac{500}{9} \Leftrightarrow x + 270 = 500 \Leftrightarrow x = 230.$

34. Let the speed of each train be x m/sec.

Then, relative speed of the two trains $= 2x$ m/sec.

So, $2x = \frac{(120+120)}{12} \Leftrightarrow 2x = 20 \Leftrightarrow x = 10.$

$\therefore$ Speed of each train = 10 m/sec = $\left(10 \times \frac{18}{5}\right)$ km/hr = 36 km/hr.

35. Speed of the first train = $\left(\frac{120}{10}\right)$ m/sec = 12 m/sec.

Speed of the second train = $\left(\frac{120}{15}\right)$ m/sec = 8 m/sec.

Relative speed = (12 + 8) = m/sec = 20 m/sec.

$\therefore$ Required time = $\frac{(120+120)}{20}$ sec = 12 sec.

36. Let the speed of the second train be x km/hr.

Relative speed = $(x + 50)$ km/hr = $\left[(x+50) \times \frac{5}{18}\right]$ m/sec = $\left(\frac{250+5x}{18}\right)$ m/sec.

Distance covered = (108 + 112) = 220 m.

$\therefore \frac{220}{\left(\frac{250+5x}{18}\right)} = 6 \Leftrightarrow 250 + 5x = 660 \Leftrightarrow x = 82$ km/hr.

37. Let the speed of train Y be x km/hr.

Speed of X relative to Y = $(120 - x)$ km/hr

$$= \left[(120-x) \times \frac{5}{18}\right] \text{m/sec} = \left(\frac{600-5x}{18}\right) \text{m/sec}.$$

$\therefore \frac{300}{\left(\frac{600-5x}{18}\right)} = 120 \Leftrightarrow 5400 = 120(600 - 5x) \Leftrightarrow x = 111.$

38. Relative speed = (36 + 45) km/hr = $\left(81 \times \frac{5}{18}\right)$ m/sec = $\left(\frac{45}{2}\right)$ m/sec.

Length of train = $\left(\frac{45}{2} \times 8\right)$ m = 180 m.

39. Relative speed = (40 – 20) km/hr = $\left(20 \times \frac{5}{18}\right)$ m/sec = $\left(\frac{50}{9}\right)$ m/sec.

Length of faster train = $\left(\frac{50}{9} \times 5\right)$ m = $\frac{250}{9}$ m = $27\frac{7}{9}$ m.

40. 2 kmph = $\left(2 \times \frac{5}{18}\right)$ m/sec = $\frac{5}{9}$ m/sec and 4 kmph = $\frac{10}{9}$ m/sec.

Let the length of the train be x metres and its speed be y m/sec.

Then, $\frac{x}{\left(y - \frac{5}{9}\right)} = 9$ and $\frac{x}{\left(y - \frac{10}{9}\right)} = 10.$

$\therefore 9y - 5 = x$ and $10(9y - 10) = 9x \Rightarrow 9y - x = 5$ and $90y - 9x = 100.$

On solving, we get : $x = 50$

$\therefore$ Length of the train is 50 m.

41. $4.5 \text{ km/hr} = \left(4.5 \times \frac{5}{18}\right) \text{m/sec} = \frac{5}{4} \text{m/sec} = 1.25 \text{ m/sec}$, and

$5.4 \text{ km/hr} = \left(5.4 \times \frac{5}{18}\right) \text{m/sec} = \frac{3}{2} \text{m/sec} = 1.5 \text{ m/sec}$.

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

Then, $(x - 1.25) \times 84 = (x - 1.5) \times 8.5$

$\Leftrightarrow 8.4x - 10.5 = 8.5x - 12.75 \Leftrightarrow 0.1x = 2.25 \Leftrightarrow x = 22.5$.

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

42. 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.

$\therefore \frac{(100 + 100)}{8} = 3x \Leftrightarrow 24x = 200 \Leftrightarrow x = \frac{25}{3}$.

So, speed of the faster train $= \frac{50}{3} \text{m/sec} = \left(\frac{50}{3} \times \frac{18}{5}\right) \text{km/hr} = 60 \text{ km/hr}$.

43. Speed of first train $= \left(\frac{150}{15}\right) \text{m/sec} = 10 \text{ m/sec}$.

Let the speed of second train be x m/sec.

Relative speed $= (10 + x)$ m/sec.

$\therefore \frac{300}{10 + x} = 8 \Leftrightarrow 300 = 80 + 8x \Leftrightarrow x = \frac{220}{8} = \frac{55}{2} \text{ m/sec}$.

So, speed of second train $= \left(\frac{55}{2} \times \frac{18}{5}\right) \text{kmph} = 99 \text{ kmph}$.

44. Let the length of the first train be x metres.

Then, the length of second train is $\left(\frac{x}{2}\right)$ metres.

Relative speed $= (48 + 42) \text{ kmph} = \left(90 \times \frac{5}{18}\right) \text{m/sec} = 25 \text{ m/sec}$.

$\therefore \frac{\left(x + \frac{x}{2}\right)}{25} = 12 \text{ or } \frac{3x}{2} = 300 \text{ or } x = 200$.

$\therefore$ Length of first train $= 200$ m.

Let the length of platform be y metres.

Speed of the first train $= \left(48 \times \frac{5}{18}\right) \text{m/sec} = \frac{40}{3} \text{m/sec}$.

$\therefore (200 + y) \times \frac{3}{40} = 45 \Leftrightarrow 600 + 3y = 1800 \Leftrightarrow y = 400$ m.

45. 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.

$\therefore \frac{27x + 17y}{x + y} = 23 \Leftrightarrow 27x + 17y = 23x + 23y \Leftrightarrow 4x = 6y \Leftrightarrow \frac{x}{y} = \frac{3}{2}$.

46. Suppose they meet x hours after 7 a.m.
Distance covered by A in x hours = $20x$ km.
Distance covered by B in $(x-1)$ hours = $25(x-1)$ km.
$\therefore \quad 20x + 25(x-1) = 110 \Leftrightarrow 45x = 135 \Leftrightarrow x = 3.$
So, they meet at 10 a.m.

47. Suppose, the distance between Meerut and Ghaziabad is x km.
Time taken by X to cover x km = 1 hour.

Time taken by Y to cover x km = $\frac{3}{2}$ hours.

$\therefore$ Speed of X = x kmph, Speed of Y = $\left(\frac{2x}{3}\right)$ kmph.

Let them meet y hours after 4 p.m. Then,

$$xy + \frac{2xy}{3} = x \Leftrightarrow y\left(1+\frac{2}{3}\right) = 1 \Leftrightarrow y = \frac{3}{5} \text{ hours} = \left(\frac{3}{5}\times 60\right) \text{ min} = 36 \text{ min}.$$

So, the two trains meet at 4.36 p.m.

48. Let us name the trains as A and B. Then,

(A's speed) : (B's speed) = $\sqrt{b} : \sqrt{a} = \sqrt{16} : \sqrt{9} = 4 : 3$.

EXERCISE 18B

(DATA SUFFICIENCY TYPE QUESTIONS)

1. A train running at a certain speed crosses a stationary engine in 20 seconds. To find out the speed of the train, which of the following information is necessary ?
   (*a*) Only the length of the train
   (*b*) Only the length of the engine
   (*c*) Either the length of the train or the length of the engine
   (*d*) Both the length of the train and the length of the engine

2. A train running at a certain speed crosses another train running in the opposite direction in 4.8 seconds. To find out the speed of the first train, which of the following information P and Q is sufficient ?
   P : The length of the first train Q : The length of the second train
   (*a*) Only P is sufficient (*b*) Only Q is sufficient
   (*c*) Either P or Q is sufficient (*d*) Both P and Q are needed
   (*e*) Both P and Q are not sufficient

Directions (*Questions 3 to 12*) : ***Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the given question. Read both the statements and***

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

3. A train crosses a signal post in x seconds. What is the length of the train ?
   I. The train crosses a platform of 100 metres in y seconds.
   II. The train is running at the speed of 60 km / hr. **(NABARD, 2002)**
4. What was the speed of the running train ? **(Bank P.O. 2000)**
   I. Length of the train was 120 metres.
   II. The train crossed the other stationary train whose length was 180 m in 4 seconds.
5. What is the speed of a running train which takes 9 seconds to cross a signal post ?
   I. The length of the train is 90 metres.
   II. The train takes 27 seconds to cross a platform of 180 metres. **(Bank P.O. 1999)**
6. What is the length of a running train ? **(S.B.I.P.O. 1998)**
   I. The train crosses a man in 9 seconds.
   II. The train crosses a 240 metre long platform in 24 seconds.
7. What is the speed of the train ? **(Bank P.O. 2003)**
   I. 280 metres long train crosses a signal pole in 18 seconds.
   II. 280 metres long train crosses a platform in 45 seconds.
8. What was the speed of a running train X ?
   I. The relative speed of train X and another train Y running in opposite direction is 160 kmph.
   II. The train Y crosses a signal post in 9 seconds.
9. What was the length of a running train crossing another 180 metre long train running in the opposite direction ? **(Bank P.O. 1998)**
   I. The relative speed of the two trains was 150 kmph.
   II. The trains took 9 seconds to cross each other.
10. A train crosses another train running in the opposite direction in x seconds. What is the speed of the train ? **(S.B.I.P.O. 2003)**
    I. Both the trains have the same length and are running at the same speed.
    II. One train crosses a pole in 5 seconds.
11. A train crosses a pole in 10 seconds. What is the length of the train ?
    I. The train crosses another train running in opposite direction with a speed of 80 km / hr in 22 seconds.
    II. The speed of the train is 108 km / hr. **(Bank P.O. 2003)**
12. What is the speed of the train whose length is 210 metres ? **(Bank P.O. 2003)**
    I. The train crosses another train of 300 metres length running in opposite direction in 10 seconds.
    II. The train crosses another train running in the same direction at the speed of 60 km / hr in 30 seconds.

Directions (*Questions 13 to 17*) : ***Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is / are necessary to answer the question.***

13. What is the speed of the train ? **(S.B.I.P.O. 2002)**
    I. The train crosses a tree in 13 seconds.
    II. The train crosses a platform of length 250 metres in 27 seconds.
    III. The train crosses another train running in the same direction in 32 seconds.
    (*a*) I and II only (*b*) II and III only (*c*) I and III only
    (*d*) Any two of the three (*e*) None of these

14. What is the speed of the train ? (M.B.A. 2002)

I. The train crosses 300 metres long platform in 21 seconds.

II. The train crosses another stationary train of equal length in $19\frac{1}{2}$ seconds.

III. The train crosses a signal pole in $9\frac{3}{4}$ seconds.

(a) I and II only (b) I and either II or III only
(c) II and either I or II only (d) III and either I or II only
(e) None of these

15. What is the speed of the train ? (Bank P.O. 2003)

I. The train crosses a signal pole in 18 seconds.
II. The train crosses a platform of equal length in 36 seconds.
III. Length of the train is 330 metres.

(a) I and II only (b) II and III only (c) I and III only
(d) III and either I or II only (e) Any two of the three

16. What is the length of the train X ?

I. Train X crosses a telegraph post in 20 seconds.
II. Train X crosses a platform of length 800 m in 100 seconds.
III. Train X passes through a tunnel 400 m long in 60 seconds.

(a) I and either II or III only (b) II and III only
(c) II and either I or III only (d) III and either I or II only
(e) Any two of the three

17. What is the speed of the train ?

I. The train passes a man walking at the rate of 3 kmph in 9 seconds.
II. The train passes a man walking at the rate of 6 kmph in 10 seconds.
III. The train is moving in the same direction in which the two men are moving.

(a) I and III only (b) II and III only
(c) I and II only (d) All I, II and III
(e) Question cannot be answered even with information in all the three statements.

Directions (*Questions 18 to 20*) : *Each of these questions is followed by three statements. You have to study the question and all the three statements given to decide whether any information provided in the statement(s) is redundant and can be dispensed with while answering the given question.*

18. How much time will the train A take to cross another train B running in opposite direction ?

I. Train A crosses a signal pole in 6 seconds.
II. Ratio of the speeds of trains A and B is 3 : 2.
III. Length of the two trains together is 500 metres.

(a) I only (b) II only
(c) III only (d) I or II only
(e) Question cannot be answered even with the information in all the three statements.

19. What is the length of a running train P crossing another running train Q ?

I. These two trains take 18 seconds to cross each other.
II. These trains are running in opposite directions.
III. The length of train Q is 180 metres. (S.B.I.P.O. 1997)

(a) I only (b) II only
(c) III only (d) All I, II and III are required
(e) Even with I, II and III, the answer cannot be obtained.

20. At what time will the train reach city X from city Y ? **(S.B.I.P.O. 1999)**

I. The train crosses another train of equal length of 200 metres and running in opposite direction in 15 seconds.

II. The train leaves city Y at 7.15 a.m. for city X situated at a distance of 558 km.

III. The 200 metres long train crosses a signal pole in 10 seconds.

(*a*) I only (*b*) II only (*c*) III only
(*d*) I or III only (*e*) All I, II and III are required.

ANSWERS

1. (*d*)	**2.** (*e*)	**3.** (*c*)	**4.** (*e*)	**5.** (*a*)	**6.** (*e*)	**7.** (*a*)	**8.** (*d*)
9. (*e*)	**10.** (*d*)	**11.** (*b*)	**12.** (*e*)	**13.** (*a*)	**14.** (*b*)	**15.** (*d*)	**16.** (*e*)
17. (*d*)	**18.** (*e*)	**19.** (*e*)	**20.** (*a*)				

SOLUTIONS

1. Time taken by the train to cross a stationary engine

$$= \frac{\text{(Length of train + Length of engine)}}{\text{(Speed of the train)}}$$

$$\Rightarrow \frac{\text{(Length of train + Length of engine)}}{\text{(Speed of the train)}} = 20 \text{ (given)}$$

Hence, to find the speed of the train, the length of the train and the length of tne engine both must be known.

$\therefore$ The correct answer is (*d*).

2. Let two trains of lengths *a* and *b* metres be moving in opposite directions at *u* m / s and *v* m / s.

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

$\therefore \quad \frac{a+b}{u+v} = 4.8.$

In order to find *u*, we must know *a*, *b* and *v*,
i.e., length of first train, length of second train and the speed of the second train.

Thus, P and Q are not sufficient.

$\therefore$ The correct answer is (*e*).

3. Let the length of the train be *a* metres.

Time taken to cross a singal post $= \frac{\text{Length of the train}}{\text{Speed of the train}} \Rightarrow x = \frac{l}{\text{Speed.}}$ ...(*i*)

Time taken to cross the platform $= \frac{(l+100)}{\text{Speed}} \Rightarrow y = \frac{l+100}{\text{Speed}}$ ...(*ii*)

Thus, from (*i*) and (*ii*), we can find *l*.

Also, II gives, speed $= \left(80 \times \frac{5}{18}\right)$ m / s $= \frac{200}{9}$ m / s.

Thus, the data in I or II alone are sufficient to answer the question.

$\therefore$ The correct answer is (*e*).

4. Speed of the first train $= \frac{\text{(sum of the lengths of the two trains)}}{\text{Time taken}}$

$$= \frac{(120 + 180)}{4} \text{ m/s} = 75 \text{ m/s}.$$

So, both the statements are necessary to get the answer.

$\therefore$ The correct answer is (*e*).

5. Speed of the train $= \frac{\text{Length of the train}}{\text{Time taken to cross the post}} = \frac{90}{9} \text{ m/s} = 10 \text{ m/s}.$

Thus, I alone gives the answer.

Time taken to cross a platform $= \frac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

$\Rightarrow$ Speed $= \frac{(l + 180)}{27}$

But, l is not given. So, speed cannot be obtained.

So, II alone does not give the answer.

$\therefore$ The correct answer is (*a*).

6. Time taken by train to cross a man $= \frac{\text{Length of train}}{\text{Speed of train}} \Rightarrow \text{Speed} = \frac{l}{9}$ ...(*i*)

Time taken by train to cross a platform $= \frac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

$\Rightarrow$ Speed $= \frac{l + 240}{24}$ ...(*ii*)

From (*i*) and (*ii*), we get $\frac{l}{9} = \frac{l + 240}{24}$.

Thus, l can be obtained. So both I and II are necessary to get the answer.

$\therefore$ The correct answer is (*c*).

7. Speed $= \frac{\text{Length of the train}}{\text{Time taken to cross the pole}} = \frac{280}{18} \text{ m/s} = \frac{140}{9} \text{ m/s}.$

$\therefore$ I alone gives the answer.

Time taken to cross the platform $= \frac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

$\Rightarrow$ Speed $= \frac{(280 + p)}{45}$ m/s.

But, p = length of platform, is not given.

$\therefore$ II is not sufficient to give the answer.

$\therefore$ The correct answer is (*a*).

8. Let the two trains of length a metres and b metres be moving in opposite directions at u m/s and v m/s. Then,

I gives, $u + v = 160$.

II gives, $v = \frac{b}{9}$.

From these equations, we cannot obtain u.

$\therefore$ The correct answer is (*d*).

9. Let the two trains of length a metres and b metres be moving in opposite directions at u m/s and v m/s.

Time taken to cross each other $= \frac{(a+b)}{(u+v)}$ sec.

Now, $b = 180$, $u + v = \left(150 \times \frac{5}{18}\right)$ m/sec $= \frac{125}{3}$ m/sec.

$\Rightarrow 9 = \frac{a+180}{(125/3)} \Rightarrow a = (375 - 180) = 195$ m.

Thus, both I and II are necessary to get the answer.

$\therefore$ The correct answer is (e).

10. Let the two trains of length a metres and b metres be moving in opposite directions at u m/s and v m/s.

Time taken to cross each other $= \frac{(a+b)}{(u+v)}$ m/sec. $\Rightarrow x = \frac{(a+a)}{(u+u)} = \frac{a}{u}$. ...(i)

Time taken to cross the pole $= \frac{\text{Length of the train}}{\text{Speed of the train}} = \frac{a}{u} \Rightarrow \frac{a}{u} = 5$ ...(ii)

From (i) and (ii) also, we cannot find u.

$\therefore$ The correct answer is (d).

11. Time taken to cross a pole $= \frac{\text{Length of train}}{\text{Speed of train}} \Rightarrow 10 = \frac{\text{Length of train}}{\left(108 \times \frac{5}{18}\right)}$

$\Rightarrow$ Length of the train = 300 m.

Clearly, II is sufficient to get the answer.

Also, I is not sufficient to get the answer.

$\therefore$ The correct answer is (b).

12. Time taken to cross the train, running in opposite directions $= \frac{(l_1 + l_2)}{(u+v)}$ sec.

$\Rightarrow 10 = \frac{(210 + 300)}{(u+v)} \Rightarrow u + v = 51.$

Time taken to cross the train, running in same direction $= \frac{(l_1 + l_2)}{(u-v)}$ sec.

$\Rightarrow 30 = \frac{(210 + 300)}{\left(u - 60 \times \frac{5}{18}\right)} \Rightarrow u = \left(17 + \frac{50}{3}\right)$ m/sec.

Thus, u and v can be obtained.

$\therefore$ Correct answer is (e).

13. Let the speed of the train be x metres/sec.

Time taken to cross a tree $= \frac{\text{Length of the train}}{\text{Speed of the train}}$

Time taken to cross a platform $= \frac{(\text{Length of train} + \text{Length of platform})}{\text{Speed of the train}}$ ...(ii)

I gives, $13 = \frac{l}{x} \Rightarrow 13x$

II gives $27 = \frac{l + 250}{x} \Rightarrow \frac{13x + 250}{x} = 24 \Rightarrow x = \frac{125}{7}$ m/sec.

Thus I and II give the speed of the train.

$\therefore$ The correct answer is (a)

14. Let the speed of the train be x m/sec.

Time taken to cross a platform $= \dfrac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

Time taken by the train to cross a stationary train

$= \dfrac{\text{(Sum of the lengths of the trains)}}{\text{Speed of moving train}}$

Time taken to cross a signal pole $= \dfrac{\text{Length of train}}{\text{Speed of train}}$

I gives, $21 = \dfrac{(l + 300)}{x}$; II gives, $\dfrac{39}{2} = \dfrac{2l}{x}$; III gives, $\dfrac{39}{4} = \dfrac{l}{x}$.

Thus, (I and II) or (I and III) give x.

$\therefore$ Correct answer is (*b*).

15. Let the speed of the train be x m/sec.

Time taken to cross a signal pole $= \dfrac{\text{Length of train}}{\text{Speed of train}}$.

Time taken to cross a platform $= \dfrac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

Length of train = 330 m.

I and III give, $18 = \dfrac{330}{x} \Rightarrow x = \dfrac{330}{18}$ m/s $= \dfrac{55}{3}$ m/s.

II and III give, $36 = \dfrac{2 \times 330}{x} \Rightarrow x = \dfrac{660}{36}$ m/s $= \dfrac{55}{3}$ m/s.

$\therefore$ Correct answer is (*d*).

16. Time taken to cross a pole $= \dfrac{\text{Length of train}}{\text{Its speed}} \Rightarrow 20 = \dfrac{l}{\text{speed}} \Rightarrow \text{speed} = \dfrac{l}{20}$ ...(*i*)

Time taken to cross a platform $= \dfrac{(l + 800)}{\text{speed}}$

$\Rightarrow 100 = \dfrac{(l + 800)}{\text{speed}} \Rightarrow \text{speed} = \dfrac{(l + 800)}{100}$ ...(*ii*)

Time taken to pass through a tunnel $= \dfrac{(l + 400)}{60}$

$\Rightarrow 60 = \dfrac{(l + 400)}{\text{speed}} \Rightarrow \text{speed} = \dfrac{(l + 400)}{60}$ ...(*iii*)

Equating any two out of three will give us l.

$\therefore$ Correct answer is (*e*).

17. Let the speed of the train be x m/sec.

III gives that the men are moving in the same direction.

I gives, time taken to pass a man $= \dfrac{l}{\left(x - 3 \times \dfrac{5}{18}\right)} = \left(\dfrac{6l}{6x - 5}\right)$ sec.

$\therefore \dfrac{6l}{6x - 5} = 9 \Rightarrow 54x - 6l = 45 \Rightarrow 18x - 2l = 15$ ...(

II gives, time taken to pass another man $= \dfrac{l}{\left(x - 6 \times \dfrac{5}{18}\right)}$ sec $= \dfrac{3l}{(3x - 5)}$ sec.

$\therefore \quad \dfrac{3l}{(3x-5)} = 10 \Rightarrow 30x - 3l = 50$ ...(ii)

On solving (i) and (ii), we get : $x = \dfrac{55}{6}$ m/sec.

Thus, all I, II, III are needed to get the answer.

$\therefore$ (d) is correct.

18. II. Let the speeds of A and B be $3x$ m/sec and $2x$ m/sec.

I. Length of train A $= (3x \times 6)$ m $= 18x$ metres.

III. Length of train B $= (500 - 18x)$ m.

Relative speed $= (3x + 2x)$ m/sec $= 5x$ m/sec.

Time taken by A to cross B $= \dfrac{\text{Sum of their lengths}}{\text{Relative speed}} = \dfrac{500}{5x}$ sec.

Thus, even with the information in all the three statements, question cannot be answered.

$\therefore$ Correct answer is (e).

19. Let the length of train P be x metres.

II. These trains are running in opposite directions.

III. Length of train Q is 180 m.

I. Time taken by P to cross Q $= \dfrac{(180 + x)}{\text{Relative speed}} \Rightarrow 18 = \dfrac{(180 + x)}{\text{Relative speed}}$

Thus, even with I, II and III, the answer cannot be obtained.

$\therefore$ Correct answer is (e).

20. III gives, speed $= \dfrac{200}{10}$ m/s $= 20$ m/s $= \left(20 \times \dfrac{18}{5}\right)$ km/hr $= 72$ km/hr.

II gives, time taken $= \left(\dfrac{558}{72}\right)$ hrs $= \dfrac{31}{4}$ hrs $= 7\dfrac{3}{4}$ hrs $= 7$ hrs 45 min.

So, the train will reach city X at 3 p.m.

Hence, I is redundant.