SOLUTIONS

1. (b) Let, length of train A = L_A
Time taken by train A = 30 sec.
length of train C = 500 m.
So speed of train A (S_A)

$= \frac{L_A + 500}{30}$

Speed of train B = 36 km/hr

$= 36 \times \frac{5}{18} = 10$ m/sec.

Time = 15 second
length = 300 meter

$(S_A + 10) = \frac{L_A + 300}{15}$

ATQ,

$(L_A + 300) = \left(\frac{L_A + 500}{30} + 10\right) \times 15$

$\Rightarrow L_A + 300 = \frac{L_A + 500 + 300}{30} \times 15$

$\Rightarrow 2L_A + 600 = L_A + 800$

$\therefore L_A = 200$ m

2. (a) $L_A = 200$, $L_B = 250$
$S_A = 68$, $S_B = 50$
ATQ,
Relative speed when travelling in same direction = (68 – 50) km/h

$= 18$ km/h $= 18 \times \frac{5}{18}$ m/s $= 5$ m/s

Required time $= \frac{(200 + 250)}{5}$

= 90 sec.

3. (b) Speed of train $= \frac{350 + 1250}{80}$

$= \frac{1600}{80} = 20$ m/s

$= 20 \times \frac{18}{5} = 72$ km/hr

4. (a) $L_m = 850$m, $L_k = 700$ m
$S_m = 62$ km/hr, $S_k = 55$ km/hr
Required time =

$\frac{(850 + 700 + 1050) \times 18}{(62 + 55) \times 5}$

$= \frac{2600 \times 18}{117 \times 5} = 80$ sec.

5. (c)

Speed of train $= \left(\frac{180 + 500}{40}\right) \times \frac{18}{5}$

$= \frac{680}{40} \times \frac{18}{5}$

$= \frac{17 \times 18}{5} = \frac{306}{5} = 61.2$ kmph

6. (a) Relative speed in same direction
= (85 – 77) km/h. = 8km/h.

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

$= \frac{360}{8} \times \frac{18}{5} = 162$ seconds

Time taken by them to cross each other = 162 seconds.

7. (b) Given
Speed of train started from Delhi = 85 km/h
Speed to train started from Puna = 67 km/h
Travelling time of both the train = Duration between 07 : 00 AM to 03 : 30 PM
= 8.5 hour
Distance covered by the train started from Delhi = 85 × 8.5
= 722.5 km
Distance covered by the train started from Puna = 67 × 8.5
= 569.5 km
Hence, The distance between Delhi and Puna
= 722.5 + 569.5 = 1292 km

8. (c) Relative Speed = (80 + 82) = 162 km/h
Both trains meet After 1 hour 30 minute,
Time = 1.5 h
Distance between the Trains = 162 × 1.5 h = 243 km

9. (c) In such a type of question we will make the time of starting the same for both the stations.
Assume, The starting time of station A is 9 am.
Now the distance
= 120 – 20 = 100 km
Relative speed
= 20 + 30 = 50 km/h

Time $= \frac{100}{50} = 2$ hour

Time of meeting = 9 am. + 2 hour
= 11 am.

10. (b) Let the train starting from Banglore be A and from Channai is B.
Given,
Speed of A = 80 km/h
Speed of B = 95 km/h
Ratio of the speed of A and B
= 16 : 19
If time is constant then distance is directly proportional to the speed.
Hence, The ratio of distance covered by A and B
= 16 : 19
Total distance cover when A and B meets = 16 + 19
= 35 units
B will cover more distance by
= 19 – 16 = 3 units
3 units = 180 km

35 units $= \frac{180}{3} \times 35 = 2100$ km

SMART APPROACH:-

Here time is constant

	A	B
Speed	→ 80	95
Distance	→ 80	95

$95x - 80x = 15x = 180$

$\therefore (80 + 95) = 175x = \frac{180}{15} \times 175$

2100 km

11. (a) Relative Speed = 40 + 32

$= 72 \times \frac{5}{18} = 20$ m/s

Time taken in crossing each other

$= \frac{121 + 99}{20} = \frac{220}{20} = 11$s

12. (b) Distance between before 10 minute

$= (120 + 80) \times \frac{10}{60} = 200 \times \frac{1}{6}$

= 33.33 km

13. (a) Let the speed of the train be S and its length be L.
Now, it crosses the first person in 12 sec
Relative speed as they move in same direction
$= S - 4$

$\Rightarrow L = (S-4)\times\frac{12}{3600}$ .....(1)

Also, it crosses the second person in 14 sec
Relative Speed = S – 6

$\Rightarrow L = (S-6)\times\frac{14}{3600}$ .....(2)

From (1) and (2)

$\Rightarrow (S-4)\times\frac{12}{3600} = (S-6)\times\frac{14}{3600}$

$\Rightarrow 12S - 48 = 14S - 84$
$\Rightarrow 12S - 14S = -84 + 48$
$\Rightarrow -2S = -36 \Rightarrow S = 18$
Hence, The speed of train
= 18km/h

SMART APPROACH:-
Distance is same
Let speed of train = S
$(S - 4) \times 12 = (S - 6) \times 14$
S = 18 km/h

14. (b) Speed of train x = 74 km/h
If Length of train x = 3D
Speed of train y = 52 km/h

Length of train y = $3D \times \frac{2}{3} = 2D$

$\because$ Both trains travelling in opposite direction
So the relative speed of train x and y
= 72 km/h + 52 km/h
= 126 km/h

$3D + 2D = 126 \times \frac{5}{18}$ m/s × 12 sec

5D = 84 × 5 = 84
Length of train x(3D)
= 84 × 3 = 252 m

15. (b) Let length of train = D m

$\because x = \frac{D+300}{30}$ m/sec

$\frac{D}{(x-6)\times\frac{5}{18}} = 20$

$\frac{D}{\frac{D+300}{30} - 6\times\frac{5}{18}} = 20$

$D = 20\left(\frac{D+300-50}{30}\right)$

$D = 2\left(\frac{D+250}{3}\right)$

D = 500 m

$x = \frac{500+300}{30}$ m/sec

$x = \frac{800}{30}\times\frac{18}{5} = 96$ km/h

16. (c) Let length of x = 3D

Lengh of y = $3D \times \frac{2}{3} = 2D$

Relative speed of trains x and y
= 74 km/h + 52 km/h
= 126 km/h

$3D + 2D = 126 \times \frac{5}{18} \times 12$ m

5D = 84 × 5
D = 84 m
Length of y (2D) = 2 × 84 = 168 m

17. (d) $\frac{400}{n} - \frac{400}{n+10} = 2$

By hit and trial
n = 40 km/h
Usual time taken by train to complete the journey = $\frac{400}{40}$
= 10 hours

18. (c)

Speed → 5 : 4
Distance → 5 : 4

1 unit → 8 km (given)

Faster engine have to travel to overtakes the slower one
= (8 × 5) = 40 km

19. (b) Length of other train = x

$\Rightarrow \frac{270+x}{(42+57)\times\frac{5}{18}} = 18$

$\Rightarrow 270 + x = 495$
$\Rightarrow x = 225$

20. (c) Length of train = 212 m

Speed = 45 km/h = $45 \times \frac{5}{18}$ m/s

Platform length = 188 m
Time to cross a platform

$= \frac{(212+188)}{45\times\frac{5}{18}} = \frac{400\times18}{45\times5} = 32$ sec.

21. (b) Let, speed of train 'B' be x km/h
Speed of train A = $(x - 16)$ km/hr
ATQ,

$\frac{384}{x-16} - \frac{384}{x} = 4$

$\Rightarrow \frac{384x - 384x + 384\times16}{x(x-16)} = 4$

$\Rightarrow 6144 = 4x^2 - 64x$
$\Rightarrow 4x^2 - 64x - 6411 = 0$
$\Rightarrow x^2 - 16x - 1536 = 0$
$\Rightarrow x^2 - 48x + 32x - 1536 = 0$
$\Rightarrow x(x - 48) + 32(x - 48) = 0$
$\Rightarrow x - 48 = 0$
$\Rightarrow x = 48$
Hence speed of train B = 48 km/h

SMART APPROACH:-
By Hit and Trial method,
Take speed of 'B'= 48 km/h

$\Rightarrow \frac{384}{32} \quad \frac{384}{48} = 4$

$\Rightarrow 4 = 4$ (Satisfied)
Hence,
The speed of train B = 48 km/h

22. (b) Speed of car = $\frac{486}{9} = 54$ km/h

Speed of train = $54 \times \frac{13}{6}$
= 117 km/h
Distance covered by the train in 6 hours
= 117 × 6 = 702 km

23. (d) Speed of the train = 54 km/h

$= 54\times\frac{5}{18} = 15$ m/s

Required time to cross the bridge

$= \frac{(342+438)}{15} = 52$ sec.

★★★★★