CLASS TEST

SN:02DLSK_CE_NOPQ_270826

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RAILWAY

CIVIL ENGINEERING

Date of Test : 27/08/2026

ANSWER KEY

1.	(a)	6.	(c)	11.	(b)	16.	(a)	21.	(a)
2.	(b)	7.	(d)	12.	(c)	17.	(a)	22.	(c)
3.	(b)	8.	(b)	13.	(a)	18.	(b)	23.	(c)
4.	(c)	9.	(d)	14.	(b)	19.	(d)	24.	(b)
5.	(a)	10.	(b)	15.	(a)	20.	(c)	25.	(b)

DETAILED EXPLANATIONS

1. (a)

$$\text{Length of each rail} = 13 \text{ m}$$

$$\text{Total number of rails required} = \frac{780}{13} = 60$$

Sleeper density is $M + 6$

$\therefore$ Number of sleepers under each rail = 13 + 6 = 19

$\therefore$ Total number of sleepers required = 19 × 60 = 1140

2. (b)

$$\text{Length of one rail} = 13 \text{ m}$$

$$\text{Number of sleepers} = 13 + 4 = 17 \text{ m}$$

$$\text{Spacing of sleepers, } S = \frac{13 \times 100}{17} \text{cm}$$

$$S = 76.47 \text{ cm}$$

$$\text{Width of ballast, } W = 22.47 \text{ cm}$$

Now,

$$\text{Optimum depth of ballast cushion} = \frac{S - W}{2}$$

$$= \frac{76.47 - 22.47}{2} = 27 \text{ cm}$$

3. (b)

$$\text{Equilibrium cant, } e_{eq.} = \frac{GV^2}{127R}$$

$$= \frac{1.676 \times 85^2}{127 \times \left(\frac{1720}{3}\right)} = 16.63 \text{ cm} > 16.5 \text{ cm}$$

Adopt,

$$e_{eq.} = 16.5 \text{ cm}$$

$$e_{Th.} = e_{eq} + CD$$

$$e_{Th} = 16.5 + 7.6 = 24.1 \text{ cm}$$

$$\frac{GV_{max}^2}{127R} = 0.241$$

$$\frac{1.676(V_{max})^2}{127 \times \left(\frac{1720}{3}\right)} = 0.241$$

$$V_{max} = 102.32 \text{ kmph} = 28.42 \text{ m/s}$$

4. (c)

Grade compensation for B.G. track is taken as 0.04% per degree of curve

So, compensation for 4 degree curve = 0.04 × 4 = 0.16%

Ruling gradient provided is 1 in 200 = $\frac{1}{200} \times 100$ = 0.5%

$\therefore$ Actual ruling gradient to be used = 0.5 – 0.16 = 0.34%

$$= \frac{1}{\left(\frac{100}{0.34}\right)} = \frac{1}{294.11} \approx \frac{1}{294} = 1 \text{ in } 294$$

5. (a)

$$\text{For branch track, } (e_{th})_{BT} = -(e_{act})_{MT} + CD$$

$$\Rightarrow \quad \frac{GV_{max}^2}{127R} = -(e_{act})_{MT} + CD$$

$$\Rightarrow \quad \frac{1.750 \times V_{max}^2}{127 \times \left(\frac{1750}{5}\right)} = -0.06 + (0.075)$$

$$\Rightarrow \quad V_{max} = 19.52 \text{ kmph} \simeq 20 \text{ kmph}$$

6. (c)

Since, V_{avg} = Weighted average of given movement of trains

$$\Rightarrow \quad V_{avg} = \frac{5(60)+8(80)+12(90)+6(110)}{5+8+12+6} = 86.45 \text{ kmph}$$

Now, $e_{th} = e_{act} + CD$

$$\Rightarrow \quad \frac{GV_{max}^2}{127R} = \frac{GV_{avg.}^2}{127R} + CD$$

$$\Rightarrow \quad \frac{1.750 \times 130^2}{127 \times \frac{1750}{2}} = \frac{1.750 \times 86.45^2}{127 \times \frac{1750}{2}} + CD$$

$$\Rightarrow \quad 0.2661 = 0.1177 + CD$$

$$\Rightarrow \quad CD = 0.1484 \text{ m} = 14.84 \text{ cm} \not> 10 \text{ cm}$$

Provide CD = 10 cm and calculate V_{max} again

$$\frac{GV_{max}^2}{127R} = \frac{GV_{avg}^2}{127R} + CD$$

$$\Rightarrow \quad \frac{1.750 \times V_{max}^2}{127 \times \frac{1750}{2}} = \frac{1.750 \times 86.45^2}{127 \times \frac{1750}{2}} + \left(\frac{10}{100}\right)$$

$$\Rightarrow \quad V_{max} = 117.574 \text{ kmph} \simeq 118 \text{ kmph}$$

7. (d)

Throw of switch is the lateral distance through which the tongue rail moves at the toe of the switch. For BG, 95 mm is the minimum throw for existing works, while 115 mm is taken as the maximum value

8. **(b)**

A fish plate is used to join two rail ends at a rail joint. It is bolted to the rails and maintains their alignment and continuity, while transferring forces across the joint.

9. (d)

Coning of wheels helps maintain the vehicle in the central position, reduces lateral movement and facilitates smooth negotiation of curves.

10. (b)

11. (b)

Flat footed rails	Bull headed rails
More strength and stiff	Less strength and stiffness for same weight
Fastenings are lesser and cheaper	Fastenings are more and costly so initial cost is high
Less maintenance cost	More maintenance cost

12. (c)

13. (a)

14. (b)

$$R = 250 \text{ m}$$
$$e = 20 \text{ cm}$$
$$V_{max} = 58.84 \text{ kmph}$$

$\therefore$ Length of transition curve $= \max \begin{cases} 7.2e = 7.2 \times 20 = 144 \text{ m} \\ 0.073(e)V_{\max} = 0.073 \times 20 \times 58.84 = 85.91 \text{ m} \end{cases}$

$$= 144 \text{ m}$$

15. (a)

Length of track, $l = (D - G)N + G\left(4N - \sqrt{1 + N^2}\right)$

Given, $N = 15$, $D = 7.5$m, $G = 1.676$ m

$$l = (7.5 - 1.676) \times 15 + 1.676\left(4 \times 15 - \sqrt{1 + 15^2}\right)$$

$$= 87.36 + 75.36 = 162.73 \text{ m}$$

The length of straight distance

$$= l - 4\,GN = 162.73 - 4 \times 1.676 \times 15 = 62.17 \text{ m}$$

16. (a)

17. (a)

$$\text{Crossing number, } N = 12$$
$$\text{Gauge, } G = 1.676 \text{ m}$$
$$\text{Outer radius, } R_0 = 1.5\, G + 2\, GN^2$$
$$R_0 = 1.5 \times 1.676 + 2 \times 1.676 \times 12^2 = 485.2 \text{ m}$$
$$\text{Central radius, } R = R_0 - \frac{G}{2} = 485.2 - \frac{1.676}{2} = 484.4 \text{ m}$$

18. (b)

19. (d)

Grade compensation of MG = 0.03% per degree of curve

For MG curve of 4°, grade compensation = 0.03 × 4 = 0.12%

Given, Ruling gradient = 1 in 150 = 0.67%

∴ Allowable gradient = 0.67 – 0.12 = 0.55% = 1 in 182

20. (c)

21. (a)

$$\text{Radius of curve, } R = \frac{1720}{4} = 430 \text{ m}$$
$$\therefore \quad \text{Extra widening} = \frac{13(B+L)^2}{R} = \frac{13(6+0.34)^2}{430} = 1.22 \text{ cm}$$

22. (c)

23. (c)

$$R_{st} = 0.15\, W_L + 0.005\, W_W$$
$$= 0.15 \times 120 + 0.005 \times (20 \times 18) = 18 + 1.8 = 19.8t$$

24. (b)

25. (b)

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