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# Railway

## CIVIL ENGINEERING

**Date of Test : 31/03/2026**

## ANSWER KEY ➤

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

## DETAILED EXPLANATIONS

**1. (c)**

For diverging track,

$$R = \frac{1720}{4} = 430 \text{ m}$$

Equilibrium super-elevation,

$$e = \frac{GV_b^2}{127R} = \frac{1.676 \times 35^2}{127 \times 430} \qquad \left\{\begin{array}{l}\text{Given, } G = 1.676 \text{ m} \\ V_b = 35 \text{ kmph}\end{array}\right\}$$

$$\Rightarrow \quad e = 0.0376 \text{ m} = 3.76 \text{ cm}$$

Now, Negative cant = Equilibrium cant – Cant deficiency

$\because$ Permissible cant deficiency for B.G. track for speeds less than 100 kmph = 7.6 cm

$\therefore$ Negative cant = 3.76 – 7.6 = (–)3.84 cm

Negative cant = Maximum permissible super elevation on the main line

= 3.84 cm

Theoretical superelevation which can be provided on the main line = (3.84 + 7.6) cm = 11.44 cm = 0.1144 m

For main line,

$$R = \frac{1720}{2} = 860 \text{ m}$$

Speed on the main track ($V_m$) can be found by,

$$e = \frac{GV_m^2}{127R}$$

$$\Rightarrow \quad 0.1144 = \frac{1.676 \times V_m^2}{127 \times 860} \quad \Rightarrow \quad V_m = 86.34 \text{ kmph}$$

**2. (d)**

Length of BG rail = 12.8 m

Number of BG rails in 800 m = $\frac{800}{12.8} = 62.5 \simeq 63$

Now, Sleeper density = 12.8 + 5 = 17.8 $\simeq$ 18 sleepers per rail

$\therefore$ Number of sleepers = 18 × 63 = 1134

**3. (a)**

Grade provided = Ruling gradient – Grade compensation

= 1 in 250 – 0.04% × 4°

$$= \frac{1}{250} - \frac{0.16}{100}$$

= 0.0024 = 0.24%

**4. (d)**

- Normally, the tread of wheels is absolutely dead centre of the head of the rail, as the wheel is coned to keep it in the central position automatically. These wheels are coned at a slope of 1 in 20.
- Coning of wheel reduces the wear and tear of the wheel flanges and rails which is due to rubbing action of flanges with inside faces of the rail head.

**5. (d)**

**6. (b)**

$$\text{Hauling capacity} = \mu WN$$

$W$ = Load on each driving axle

$\Rightarrow W = 10 \times 2 = 20$ tonnes

$N$ = Number of axles

$\Rightarrow N = 3$

$\therefore$ Hauling capacity $= 0.3 \times 20 \times 3 = 18$ tonnes

**7. (c)**

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

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

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

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

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

$\Rightarrow 0.2661 = 0.1177 + CD$

$\Rightarrow CD = 0.1484$ m $= 14.84$ cm $\not>$ 10 cm

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

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

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

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

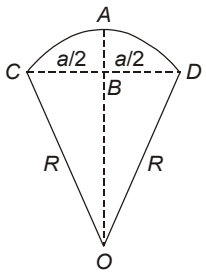
**8. (c)**

$$\text{Internal force developed, } F = \alpha TEA = 2 \times 10^{-5} \times 30 \times 20 \times 10^5 \times 60$$
$$= 72000 \text{ kg}$$
$$\text{Resistance of track} = 720 \text{ kg/km}$$
$$\therefore \quad \text{Length to resist at one end} = \frac{72000}{720} \text{ km}$$
$$= 100 \text{ km}$$
$$\therefore \quad \text{Total breathing length required} = 2 \times 100 = 200 \text{ km}$$

**9. (b)**

**10 (c)**

Given: Versine = $V = AB = 2$ cm, $a = 11.8$ m




$$AB \times (2AO - AB) = CB \times BD$$

(Property of triangle)

$$V \times (2R - V) = \frac{a}{2} \times \frac{a}{2}$$
$$2RV - V^2 = \frac{a^2}{4}$$
$$2RV = \frac{a^2}{4} \qquad (\because \quad V << R)$$
$$V = \frac{a^2}{8R}$$
$$R = \frac{(11.8)^2}{8 \times 0.02} = 870.25 \text{ m}$$

**11. (b)**

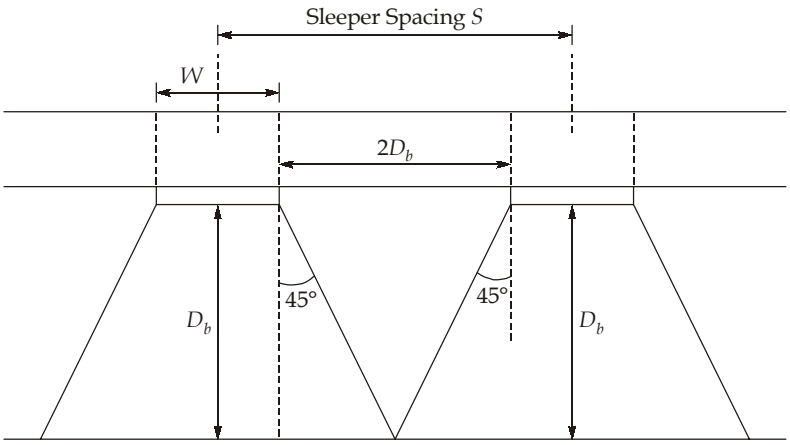
**12. (a)**

**13. (a)**

The length of straight distance $= DN - GN - G\sqrt{1+N^2}$

$= 7.5 \times 16 - 1.676 \times 16 - 1.676\sqrt{1+16^2} = 66.31$ m

**14. (d)**




From figure,

$S = 2D_b + W$

$$D_b = \frac{S-W}{2} = \frac{\frac{13}{20} - 0.25}{2} = 0.2 \text{ m} = 20 \text{ cm}$$

**15. (d)**

**16. (b)**

**17. (a)**

**18. (a)**

**19. (a)**

The distance at which outer signal is to be placed, is found on the basis of maximum allowable speed. It is 540 m for BG track in India.

**20. (b)**

**21. (c)**

$$w_e = \frac{13(B+L)^2}{R} = \frac{13(6+0.05)^2}{250}$$

$$w_e = 1.903 \text{ cm} > 1 \text{ cm}$$

Taking, $w_e = 1$ cm

**22. (c)**

Degree of curvature of curve,

$D = 5°$

For a BG track, $G = 1.676$ m

$V = 80$ km/h

$$\text{Radius of curvature, } R = \frac{1718.9}{D} = \frac{1718.9}{5°} = 343.78 \text{ m}$$

$$\text{Superelevation, } e = \frac{GV^2}{127R} = \frac{1.676 \times 80^2}{127 \times 343.78} = 0.2456 \text{ m} = 24.56 \text{ cm}$$

But equilibrium cant in a BG track should not be greater than 16.5 cm.

**23. (c)**

The types of railway yards are:

**(i) Goods yard :** The main function is to provide facilities for receiving, loading, unloading and delivery of goods and the movement of goods vehicle.

**(ii) Marshalling yard :** The main function is breakup, reform and dispatch of trains onwards. i.e., reception, sorting and departure.

**(iii) Locomotive yard :** Locomotive yard for housing locomotive. All the facilities for oil filing, watering repairing, cleaning, etc. are provided.

**(iv) Passenger bogie yard :** Passenger bogie yard provide facilities for safe movement of passenger and vehicles for the passengers.

**24. (d)**

**25. (a)**

Cant deficiency = Theoretical cant – actual cant

Theoretical cant is provided on the basis of equilibrium speed while cant is provided at actual speed. So if actual speed is more than equilibrium speed, cant deficiency is caused.

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