CLASS TEST

S.No. : 01 IG_CE_E_100522

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RAILWAY ENGINEERING

CIVIL ENGINEERING

Date of Test : 10/05/2022

ANSWER KEY

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

1. (a)

$$\text{Length of each rail, } n = \frac{26}{2} = 13 \text{ m}$$

$$\text{Sleeper density} = n + 6 = 13 + 6 = 19$$

$$\text{Total number of rails required} = \frac{1690}{13} = 130$$

$$\therefore \text{ Total number of sleepers} = \text{Number of rails} \times \text{Sleeper density}$$

$$= 130 \times 19 = 2470$$

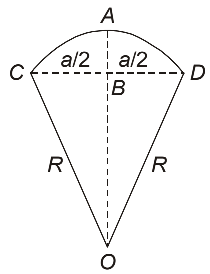
4. (d)

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.

6 (c)

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



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

(Property of triangle)

$$V \times (2R - V) = \frac{a}{2} \times \frac{a}{2}$$

$$2RV - V^2 = \frac{a^2}{4}$$

$$2RV = \frac{a^2}{4} \qquad (\because \; V << R)$$

$$V = \frac{a^2}{8R}$$

$$R = \frac{(11.8)^2}{8 \times 0.02} = 870.25 \text{ m}$$

7. (c)

Data given

$$V = 60 \text{ kmph}$$

$$R = 800 \text{ m}$$

$$e = \frac{GV^2}{127R} = \frac{(60)^2 \times 1.680}{127 \times 800}$$

$$= 0.059527 \text{ m} = 59.527 \text{ mm}$$

8. (a)

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

Given $N = 10$

$D = 5$ m

$G = 1.676$ m

$l = (5 - 1.676) \times 10 + 1.676\,(4 \times 10 - \sqrt{1 + 10^2})$

$= 83.44$ m

The length of straight distance $= l - 4GN$

$= 83.44 - (4 \times 1.676 \times 10) = 16.4$ m

9. (c)

$$D_{min} = \frac{s - w}{2} = \frac{\left(\frac{13}{19} \times 100\right) - 25}{2} = 21.71 \text{ cm}$$

10. (a)

Corrugations occur:

(i) Where the ballast consists of broken bricks

(ii) Where brakes are applied to trains for stopping them

(iii) Where trains start

(iv) In electrified sections

(v) In long tunnels

11. (a)

Internal force developed, $F = A(T\alpha A) = 2 \times 10^{-5} \times 30 \times 20 \times 10^5 \times 60$

$= 72000$ kg

Resistance of sleeper $= 350$ kg/km

$\therefore$ No. of sleeper $= \frac{72000}{350} = 206 \text{ sleeper}$

$\therefore$ Breathing length $= 2[(n-1)s] = 2[(20 - 1) \times 0.30] = 1231$ m

13. (b)

Let W = Weight of the train

and x = Required gradient

Resistance due to ruling gradient $= \frac{1}{200}W$

Resistance due to required gradient $= \frac{1}{x}W$

Resistance due to 2 degree curve $= 0.0004 \times 2 \times W$

So, according to question

$$\frac{W}{x} + 0.0004 \times 2 \times W = \frac{1}{200}W$$

$$\Rightarrow \qquad \frac{1}{x} = \frac{21}{5000}$$

$$\Rightarrow \qquad \frac{1}{x} = \frac{1}{238.1} \simeq \frac{1}{238}$$

14. (c)

Flangeway clearance is the distance between adjacent faces of the stock rail (or running rail) and the check (or guard) rails. Heel divergence is the distance between the running faces of the stock rail and gauge face of the tongue rail when measured at the heel of the switch.

16. (b)

Grade compensation = 0.04 × 3 = 0.12%

$$\text{Permissible gradient} = \frac{1}{250} - \frac{12}{10000} = \frac{1}{357}$$

17. (c)

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

18. (b)

Grade compensation for *BG* curve = 0.04% per degree curve

Total grade compensation = 0.04 × 4 = 0.16%

Gradient provided = 0.5% – 0.16% = 0.34%

19. (c)

Curve resistance = 0.0004 DW

= 0.0004 × 4 × 50 = 0.08 tonnes

20. (b)

The length of the transition curve is the larger out of the following three values.

(i) $L = 7.20 \times e = 7.20 \times 12 = 86.4$ m

(ii) $L = 0.073\,D \times V_{max} = 0.073 \times 7.6 \times 100$

$= 55.48$ m

(iii) $L = 0.073\,e \times V_{max} = 0.073 \times 12 \times 100$

$= 87.6$ m

Hence length of transition curve = 87.6 m.

21. (c)

$$R = \frac{0.388w^2}{\frac{T}{2} - s} = \frac{0.388 \times 20^2}{\frac{22.5}{2} - \left[6 + \frac{7}{2}\right]} = 88.38 \text{ m}$$

24. (c)

$$\text{Landing runway length } 1800 + \frac{0.07}{300} \times 600 \times 1800 = 2052 \text{ m}$$

Number of landing distance = 0.6 × 2052 = 1231.2 m

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