S.No. : 02 IG_CE_A+C_150523

MADE EASY
India's Best Institute for IES, GATE & PSUs

Delhi | Bhopal | Hyderabad | Jaipur | Pune | Bhubaneswar | Kolkata

Web: www.madeeasy.in | **E-mail:** info@madeeasy.in | **Ph:** 011-45124612

SURVEYING

CIVIL ENGINEERING

Date of Test : 15/05/2023

ANSWER KEY ➤

1.	(b)	7.	(b)	13.	(c)	19.	(d)	25.	(b)
2.	(a)	8.	(b)	14.	(b)	20.	(a)	26.	(c)
3.	(d)	9.	(c)	15.	(a)	21.	(d)	27.	(b)
4.	(d)	10.	(b)	16.	(b)	22.	(a)	28.	(b)
5.	(c)	11.	(d)	17.	(c)	23.	(b)	29.	(d)
6.	(b)	12.	(b)	18.	(b)	24.	(c)	30.	(d)

DETAILED EXPLANATIONS

1. (b)

Actual ground length covered,

$$L = (1 - P_l)\, l \times S$$

$$= (1 - 0.65) \times 20 \times \frac{10,000}{100 \times 10^3} \text{ km}$$

$$= 0.7 \text{ km}$$

2. (a)

Invar tapes are made of an alloy of nickel (36%) and steel (64%) having very low coefficient of thermal expansion.

- Invar tapes are mainly used for high degree of precision required for base measurements.
- Invar tapes is less affected by temperature changes.
- They need the greatest care to handle them to avoid bending and kining.

3. (d)

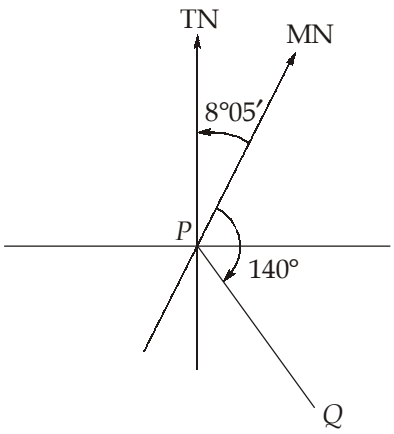
Isogonic lines: It is the line passing through points on the earth surface at which declination is same at a given point.

Agonic lines: These are special isogonic lines which pass through points having zero declination.

Isoclinic lines: The imaginary line joining the points having same dip on the surface of the earth.

Aclinic lines: The imaginary line joining the points with no dip.

4. (d)



True bearing of PQ = Magnetic bearing + East magnetic declination

$= 140° + 8°05'$

$= 148°05'$

5. (c)

$$\text{Most probable angle} = \frac{2 \times 30°00'30'' + 4 \times 30°00'20''}{6} = 30°00'23.33''$$

6. (b)

$$\alpha = \frac{S}{nD} \times 206265''$$

$$\therefore \quad S = \frac{\alpha nD}{206265} = \frac{30 \times 2 \times 150}{206265} = 0.0436 \text{ m}$$

7. (b)

RL of instrument station = 102.680 m
Height of trunnion axis = 1.560 m
Hence RL of line of collimation = 120.680 + 1.560 = 104.24 m
Now, RL of staff station = 104.24 – 1.285 = 102.955 m

Hence option (b) is correct.

8. (b)

$$V = h\left[\frac{A_1 + A_n}{2} + A_2 + A_3 + A_4\right]$$

$$= 5\left[\frac{20 + 1100}{2} + 100 + 400 + 900\right] \times 10^4$$

$$= 9800 \times 10^4 \text{ m}^3$$

9. (c)

Triangulation stations are selected, keeping in view of following considerations:

1. Intervisiblity of triangulation stations.
2. Easy access to the stations with the instrument.
3. Various triangulation stations should form well conditioned triangles.

A good signal should fulfill the following requirements:

1. It should be conspicuous i.e., it should be clearly visible from a distance against any background.
2. It should be capable of being accurately centered over the station mark.

10. (b)

Remote sensing is defined as the process or technique of obtaining information about an object, area or phenomenon through the analysis of data acquired by a device without being in contact with the object and the phenomenon being studied.

Application of remote sensing: Agriculture, forestry, land use and solids, geology, urban land use, water resources, coastal environment, ocean resources, watershed, environment, digital elevation models, disasters, facilities managements.

11. (d)

The RL of the beam = 150 m
The BS on the beam = 1.505 m
HI of the instrument = 150 + 1.505 = 151.505 m

The inverted staff reading at the underside of the beam = 3.995 m
The RL at the underside of the beam = 151.505 + 3.995 = 155.5 m

12. (b)

Longitude of the place = 94°20′E

Longitude of the standard meridian = 78°30′E

∴ Difference in longitude = 94°20′ – 78°30′ = 15°50′

= 1 h 3m 20 s

The place is east of standard meridian

∴ Standard time = LMT – Difference in longitude = LMT – 1 h 3 m 20 s

⇒ LMT = 10 h 06 m 18 s + 1 h 3 m 20 s = 11 h 09 m 38 s

13. (c)

The height of rise = $0.0673\ D^2$

$= 0.0673 \times (50)^2$

= 168.25 m

14. (b)

$$\text{Length of long chord } (L) = 2R\sin\left(\frac{\Delta}{2}\right)$$

$$\text{Apex distance } (E) = R\ \text{cosec}\left(\frac{\Delta}{2}\right)$$

⇒ Deflection angle for which length of long chord and apex distance will be equal,

$$2R\sin\left(\frac{\Delta}{2}\right) = R\ \text{cosec}\left(\frac{\Delta}{2}\right)$$

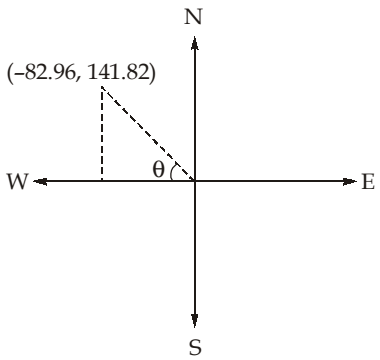
$$\sin^2\left(\frac{\Delta}{2}\right) = \frac{1}{2}$$

$$\sin\left(\frac{\Delta}{2}\right) = \frac{1}{\sqrt{2}}$$

$$\frac{\Delta}{2} = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right) = \frac{\pi}{4}$$

$$\Delta = \frac{\pi}{2}$$

15. (a)



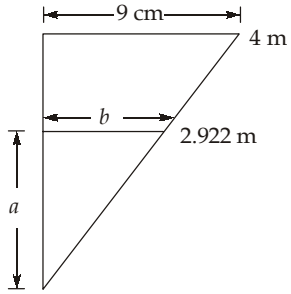
$$\tan\theta = \frac{141.82}{82.96} = 1.7095°$$

$\therefore$ $\theta = \tan^{-1}(1.7095) = 59.674°$

$WCB = 270 + \theta = 270° + 59.674° = 329.674°$

$= 329.674° \times \frac{\pi}{180°}$ rad $= 5.75$ rad

16. (b)



$\frac{b}{9} = \frac{2.922}{4}$

$\Rightarrow$ $b = 6.5745$ cm

$\therefore$ Correct reading $(a) = \sqrt{2.922^2 - (0.065745)^2}$

$= 2.92126$ m $\simeq 2.9213$ m

17. (c)

Average scale of photograph

$= \frac{f}{H - h_{avg}}$

$h_{avg} = \frac{1}{4}(1250 + 1650 + 1486 + 1501) = 1471.75$ m

Average scale $= \frac{0.160}{3200 - 1471.75} = \frac{0.16}{1728.25}$

$= \frac{1}{10801.56} \simeq \frac{1}{10802}$

18. (b)

19. (d)

Angle $= \frac{\alpha}{2} = 0.5\alpha$

weight $= 2$

Weight of angle $\alpha = (2) \times 0.5^2$

Weight of angle $0.25\alpha = \frac{(2) \times 0.5^2}{0.25^2} = 8$

20. (a)

$$\text{Reduced level of } B = HI - IS$$
$$x = 101.605 - 1.285 = 100.32 \text{ m}$$

Point C is change point, as there is a backsight entered against it.

$$\text{Corresponding fore sight} = 101.605 - 100.62 = 0.985$$

There is a new instrument height for the BS on C.

$$z = 100.620 + 1.305 = 101.925$$

21. (d)

$$\text{Correction in line } AB = \frac{-h^2}{2L} = -\frac{1.2^2}{2\times 35} = -0.02057 \text{ m}$$

$$\text{Correction in line } BC = \frac{-h^2}{2L} = -\frac{2^2}{2\times 40} = -0.05 \text{ m}$$

$$\text{Correction in line } CD = \frac{-h^2}{2L} = -\frac{1.8^2}{2\times 80} = -0.02025 \text{ m}$$

$\therefore$ Corrected horizontal distance $= 35 + 40 + 80 - [0.02057 + 0.05 + 0.02025]$
$= 154.909$ m

22. (a)

The difference of levels A and B,

$$\Delta h = \frac{(2.595 - 1.155) + (2.415 - 0.985)}{2} = 1.435 \text{ m}$$

$\therefore$ True reading at B when instrument is at

$$A = 1.155 + 1.435 = 2.590 \text{ m}$$

$\therefore$ Error $= 2.595 - 2.590 = +0.005$ m

Let's assume collimation error is in upward direction (i.e., positive error)

Error equation:

Total error = Collimation error + Combined error due to curvature and retraction

$$\Rightarrow \quad 0.005 = E_C + \frac{6}{7}\times\frac{800^2}{2\times 6370\times 1000}$$

$$\Rightarrow \quad E_C = -0.03805 \text{ m i.e. collimation error is in downward direction}$$

$$\Rightarrow \quad E_C = 38.05 \text{ mm (Downwards)}$$

23. (b)

$$\text{Scale} = \frac{1}{5000}, \quad S = 5000,$$

Area, $A = 100 \text{ km}^2$

Length recorded by 1 photo $= ls\,(1 - p_s)$
$= 150 \times 5000 \times (1 - 0.7) \times 10^{-6}$
$= 0.225$ km

Width recorded by 1 photo $= bs\,(1 - p_s)$

$= 150 \times 5000 \times (1 - 0.4) \times 10^{-6}$

$= 0.45$ km

Area recorded by 1 photo $= (0.225 \times 0.45) = 0.10125$ km^2

No. of photos required,

$$N = \frac{A}{a'} = \frac{100}{0.10125} = 987.654 \text{ photos}$$

24. (c)

25. (b)

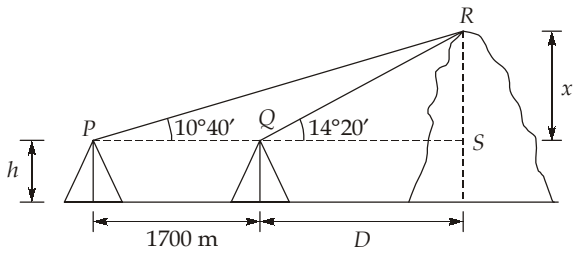
$A = \frac{d}{3}$ [(First ordinate + Last ordinate) + 4 (Sum of even ordinates) + 2(Sum of odd ordinates)]

$$\Rightarrow \quad A = \frac{d}{3}\left[(O_1 + O_9) + 4(O_2 + O_4 + O_6 + O_8) + 2(O_3 + O_5 + O_7)\right]$$

$$\Rightarrow \quad A = \frac{30}{3}\left[(0 + 0) + 4(6.5 + 5.8 + 7.6 + 5.8) + 2(7.0 + 4.5 + 6.0)\right]$$

$$\Rightarrow \quad A = 1378 \text{ m}^2$$

26. (c)



In ΔPRS,

$$\tan 10°40' = \frac{x}{1700 + D}$$

$$\Rightarrow \quad x - 0.188D = 320.194 \quad \ldots(1)$$

In ΔQRS, $\tan 14°20' = \frac{x}{D}$

$$\Rightarrow \quad x - 0.256\,D = 0 \quad \ldots(2)$$

From (1) and (2) $x = 1205.44$ m and $D = 4708.74$ m

$\therefore$ Elevation of top of hill $= x + h$

$= 1205.44 + 436.50 = 1641.94$ m

27. (b)

In surveyor's compass:

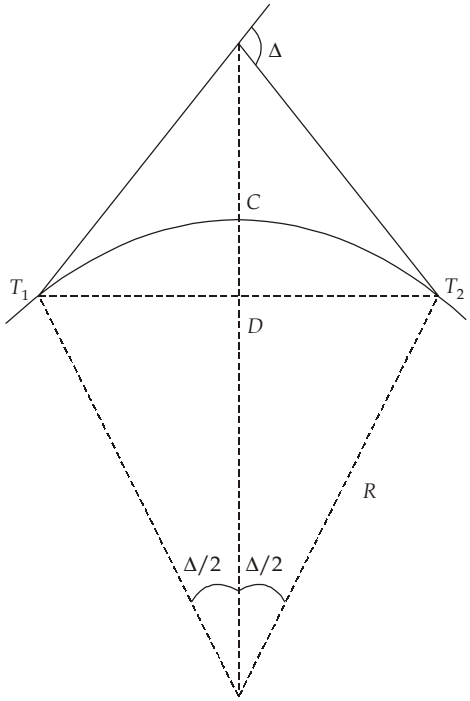
- The graduated card or scale ring is directly. Fixed to the box, which governs the size of compass.
- Used for measurement of quadrantal bearings.

28. (b)

Parallax bar: It is a instrument used to determine the apparent displacement of a point with respect to a reference point or a system.

Pantagraph: It is a instrument used of enlarging and reducing a plan already drawn.

29. (d)



- Tangent length $(VT_1) = R\tan\frac{\Delta}{2}$
- Apex distance $(VC) = R\left(\sec\frac{\Delta}{2}-1\right)$
- Length of long chord $(T_1DT_2) = 2R\sin\frac{\Delta}{2}$
- Mid-ordinate $(CD) = R\left(1-\cos\frac{\Delta}{2}\right) = R\,\text{versine}\frac{\Delta}{2}$

Hence option (d) is correct.

30. (d)

Length of curve, $l = \text{PT} - \text{PC}$

$\Rightarrow \quad l = 2999.4 - 2658.3$

$\Rightarrow \quad l = 341.1 \text{ m}$

We know, $\dfrac{l}{\Delta} = \dfrac{2\pi R}{360^\circ}$

$\Rightarrow \quad \dfrac{341.1}{50^\circ} = \dfrac{2\pi R}{360^\circ}$

$\Rightarrow \quad R = 390.87 \text{ m} \simeq 391 \text{ m}$

■■■■