GATE Architecture and Planning

Sample Paper – 8

Duration: 128 Minutes **Maximum Marks: 72**

Instructions

- This paper contains **46 questions** covering the core **Architecture and Planning (AR)** subject of the GATE paper conducted by the IITs and IISc (General Aptitude and Engineering Mathematics are provided as separate papers).
- **Q1–Q20 carry 1 mark each** and **Q21–Q46 carry 2 marks each**, for a total of **72 marks**.
- Each question carries **negative marking of one-third of its allotted marks**: a wrong 1-mark question costs **0.33** and a wrong 2-mark question costs **0.67**. Unattempted questions carry no penalty.
- Every question here is a single-correct **MCQ**. The real GATE paper also has Multiple Select (MSQ) and Numerical Answer Type (NAT) questions, and **those carry no negative marking**.
- Attempt this paper in one timed sitting of about **128 minutes**, the share this core subject earns at GATE's overall pace of 180 minutes for 65 questions. Use standard code values (IS codes, NBC) and $g = 9.81$ m/s^2 unless stated otherwise.

Architecture, Design and History of Architecture

Q1. Fallingwater (the Kaufmann Residence, 1935), boldly cantilevered over a waterfall in Pennsylvania and hailed as a masterwork of organic architecture, was designed by: [1 mark]

(A) Louis Kahn

(B) Frank Lloyd Wright

(C) Alvar Aalto

(D) Le Corbusier

Q2. The National Assembly Building (Jatiya Sangsad Bhaban) at Dhaka, with its monumental geometric masses pierced by huge circular and triangular openings that filter daylight, was designed by: [1 mark]

(A) Le Corbusier

(B) B. V. Doshi

(C) Louis Kahn

(D) Charles Correa

Q3. The gently curving free-form timber, the human-centred detailing of the Paimio Sanatorium and the celebrated Savoy Vase are associated with the Finnish master of organic modernism: [1 mark]

(A) Alvar Aalto

(B) Eliel Saarinen

(C) Sverre Fehn

(D) Arne Jacobsen

Q4. The design philosophy holding that a building should grow naturally out of its site and materials, harmonising with nature so that form, structure and setting become one unified whole (championed by Frank Lloyd Wright), is called: [1 mark]

(A) Organic architecture

(B) Brutalism

(C) Deconstructivism

(D) Neoclassicism

Q5. Louis Kahn's ordering idea that clearly separates the major functional spaces from the ancillary spaces (stairs, ducts, toilets, shafts) that support them is known as the concept of: [1 mark]

(A) Free plan

(B) Raumplan

(C) Poché planning

(D) Servant and served spaces

Q6. The Solomon R. Guggenheim Museum in New York, whose galleries spiral upward along one continuous ramp within a great top-lit rotunda, was designed by: [1 mark]

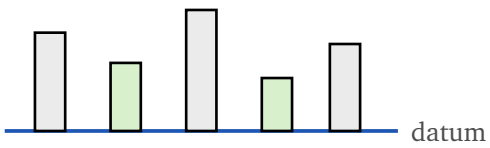
(A) Louis Kahn

(B) Frank Lloyd Wright

(C) Frank Gehry

(D) Mies van der Rohe

Q7. In the composition below, a single continuous line or surface (here a repeated base line) collects a set of otherwise loose elements and organises them. This ordering device is called a: [1 mark]



(A) Node

(B) Axis

(C) Datum

(D) Module

Q8. Frank Lloyd Wright's low, ground-hugging houses of about 1900–1917 in the American Midwest, marked by strong horizontal lines, sweeping overhanging eaves, bands of windows and open flowing plans, are collectively known as the: [1 mark]

(A) Usonian houses

(B) Prairie houses

(C) Shingle-style houses

(D) Ranch houses

Building Construction, Materials and Management

Q9. Fibre-Reinforced Polymer (FRP) composites, used for cladding, gratings and repair jackets, achieve their high strength-to-weight ratio mainly because they consist of: [1 mark]

(A) a solid metallic core clad in plastic

(B) air voids deliberately trapped in the matrix

(C) high-strength fibres (glass or carbon) embedded in and bonded by a polymer matrix

(D) the low density of the polymer resin acting alone

Q10. The electrochemical process that thickens the naturally occurring protective oxide film on aluminium, improving its corrosion resistance and allowing it to be dyed in colours, is called: [1 mark]

(A) Anodising

(B) Galvanising

(C) Tempering

(D) Vulcanising

Q11. Float glass, the standard flat glass used for windows and facades, owes its very flat, parallel and optically clear surfaces to the fact that, during manufacture, the molten glass ribbon is: [1 mark]

(A) pressed between two heated steel rollers

(B) blown by hand into open moulds

(C) drawn vertically upward out of the furnace

(D) floated on a bath of molten tin

Q12. In PERT, given the optimistic time t_o, the most likely time t_m and the pessimistic time t_p of an activity, its expected (mean) duration t_E is estimated as: **[1 mark]**

(A) $t_E = \dfrac{t_o + 4t_m + t_p}{6}$

(B) $t_E = \dfrac{t_o + t_m + t_p}{3}$

(C) $t_E = \dfrac{t_o + 2t_m + t_p}{4}$

(D) $t_E = \dfrac{t_o + t_p}{2}$

Q13. A non-load-bearing external building envelope, typically of aluminium framing with glass or panel infill, that is hung from the edges of the floor slabs and carries only its own weight and wind load, is called a: **[1 mark]**

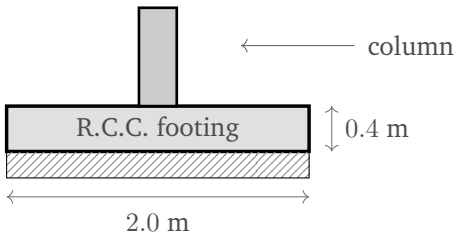
(A) Shear wall

(B) Cavity wall

(C) Load-bearing wall

(D) Curtain wall

Q14. A rectangular reinforced-concrete footing is 2.0 m $\times$ 1.5 m in plan and 0.4 m thick, as shown in section. The volume of concrete required to cast this footing is: **[1 mark]**



(A) 3.0 m^3

(B) 1.2 m^3

(C) 0.8 m^3

(D) 1.5 m^3

Q15. Laminated safety glass, used in facades and overhead glazing, holds together on impact and resists shattering because two or more glass plies are bonded by an interlayer of: [1 mark]

(A) polyvinyl butyral (PVB)

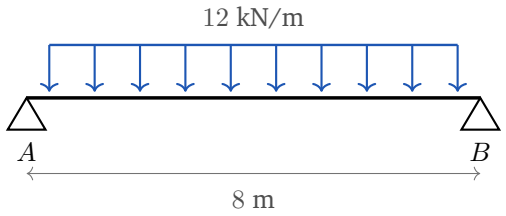
(B) epoxy grout

(C) molten tin

(D) sodium silicate solution

Building Structures and Systems

Q16. A simply supported beam of span 8 m carries a uniformly distributed load of 12 kN/m over its entire length, as shown. The maximum bending moment (at midspan) is: [1 mark]



(A) 48 kN·m

(B) 24 kN·m

(C) 120 kN·m

(D) 96 kN·m

Q17. In the moment distribution method for analysing rigid frames, the distribution factor of a member at a rigid joint is defined as the ratio of: [1 mark]

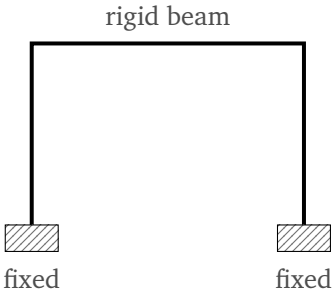
(A) that member's stiffness to the sum of the stiffnesses of all members meeting at that joint

(B) that member's length to the total length of all members at the joint

(C) the load on that member to the total load at the joint

(D) that member's moment of inertia to its cross-sectional area

Q18. The single-bay, single-storey portal frame shown has both column bases fixed and rigid (moment-resisting) beam-column joints. Its degree of static indeterminacy is: **[1 mark]**



(A) 1

(B) 3

(C) 0

(D) 6

Q19. For a prismatic beam fixed at both ends and carrying a single concentrated load W at its midspan, the magnitude of the fixed-end moment developed at each support is: **[1 mark]**

(A) $\frac{WL}{12}$

(B) $\frac{WL}{4}$

(C) $\frac{WL}{2}$

(D) $\frac{WL}{8}$

Q20. In the moment distribution method, the carry-over factor for a prismatic member whose far end is fixed (moment carried from the near end to the far end) is: **[1 mark]**

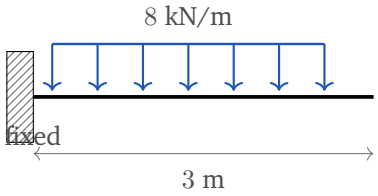
(A) 1

(B) $\frac{1}{4}$

(C) $\frac{3}{4}$

(D) $\frac{1}{2}$

Q21. A cantilever beam of length 3 m carries a uniformly distributed load of 8 kN/m over its entire length, as shown. The magnitude of the bending moment at the fixed support is: **[2 marks]**



(A) 24 kN·m

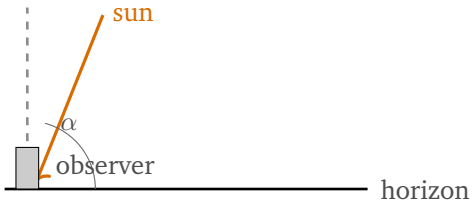
(B) 36 kN·m

(C) 72 kN·m

(D) 12 kN·m

Environmental Design and Building Services

Q22. At solar noon on the summer solstice, the solar declination is $+23.5°$. For a location on the Tropic of Cancer (latitude $23.5°$ N), the solar altitude of the noon sun, measured from the horizontal as shown, is: **[2 marks]**



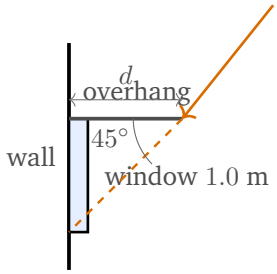
(A) $90°$

(B) $66.5°$

(C) $43°$

(D) $23.5°$

Q23. A horizontal overhang is to be provided at the head of a window so that the whole window height of 1.0 m is just shaded when the solar altitude is $45°$, as shown. The required horizontal projection (depth) of the overhang is: **[2 marks]**



(A) 0.5 m

(B) 2.0 m

(C) 1.0 m

(D) 1.5 m

Q24. In shading-device design, a plain horizontal overhang above a window is characterised on the vertical (sectional) plane and is therefore described chiefly by its: **[2 marks]**

(A) vertical shadow angle (VSA)

(B) horizontal shadow angle (HSA)

(C) solar azimuth angle only

(D) solar declination angle only

Q25. Using Sabine's formula $\mathrm{RT}_{60} = \dfrac{0.161\,V}{A}$, an auditorium of volume $V = 12000$ m^3 is to have a reverberation time of 1.6 s. The total sound absorption A that must be provided is nearest to: **[2 marks]**

(A) 600 sabins

(B) 1200 sabins

(C) 2400 sabins

(D) 300 sabins

Q26. On the two equinox days (about 21 March and 23 September), when the sun rises due east and sets due west and day and night are of equal length, the solar declination angle is: **[2 marks]**

(A) $+23.5^\circ$

(B) -23.5°

(C) 0°

(D) $+11.75^\circ$

Q27. The overall heat-transfer coefficient (the U-value) of a building wall or roof, which measures the rate of heat flow through unit area per unit temperature difference, is expressed in the SI units: [2 marks]

(A) $\text{W/m} \cdot \text{K}$

(B) $\text{W/m}^2 \cdot \text{K}$

(C) W/K

(D) $\text{J/kg} \cdot \text{K}$

Q28. The daylight factor at a point inside a room, a standard measure of daylighting adequacy, is defined as the ratio of: [2 marks]

(A) the direct sunlight to the diffuse skylight at the point

(B) the glazed window area to the floor area of the room

(C) the indoor illuminance at the point to the simultaneous outdoor illuminance from an unobstructed overcast sky, expressed as a percentage

(D) the total lamp lumens installed to the room floor area

Urban Design and Landscape Architecture

Q29. In urban design, keeping the ground floors of buildings along a street lined with shops, doors, display windows and other visible activity, so as to enliven the pavement and improve the pedestrian experience, is described as providing: [2 marks]

(A) a deep front setback

(B) an active (lively) street frontage

(C) a landscaped buffer strip

(D) a gated frontage

Q30. The landscape-design technique of deliberately drawing a distant view lying outside the site (a hill, a temple spire or a lake) into the garden composition, so that it reads as part of the design, is known as: **[2 marks]**

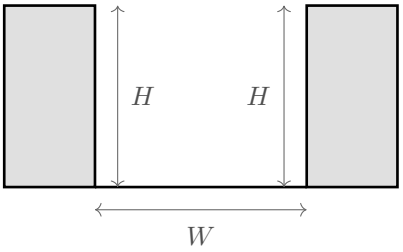
(A) Topiary

(B) Parterre

(C) Borrowed landscape (shakkei)

(D) Pergola

Q31. For the street shown in section, the ratio of the height H of the buildings that flank the space to the width W between them (H/W) is the key urban-design measure of: **[2 marks]**



(A) the sense of spatial enclosure of the street

(B) the floor area ratio of the plots

(C) the ground coverage of the plots

(D) the residential population density

Q32. A linear strip of public open space running along a river, a ridge or a disused railway alignment, developed for recreation and non-motorised movement and often linking a chain of parks, is called a: **[2 marks]**

(A) Boulevard

(B) Greenway

(C) Cul-de-sac

(D) Esplanade

Q33. In landscape design, planting a dense row of tall trees or shrubs specifically to block an unpleasant view or to hide a service yard from the main spaces is an example of using vegetation for: **[2 marks]**

(A) providing a single accent (focal) point

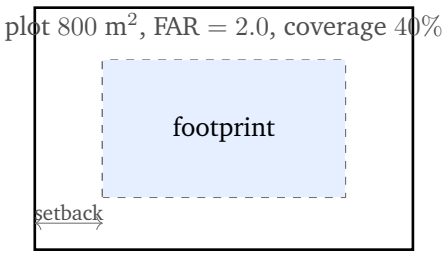
(B) framing a distant view

(C) screening

(D) ground cover

Urban and Regional Planning and Housing

Q34. A plot of area 800 m^2 carries a permissible Floor Area Ratio (FAR/FSI) of 2.0, while the ground coverage is limited to 40% of the plot, as sketched. The maximum permissible total built-up area and the resulting number of floors are: **[2 marks]**



(A) 1600 m^2 built-up, 2 floors

(B) 320 m^2 built-up, 5 floors

(C) 800 m^2 built-up, 4 floors

(D) 1600 m^2 built-up, 5 floors

Q35. The ground coverage (building coverage ratio) permitted on a plot is defined as: **[2 marks]**

(A) the ratio of the ground-floor built-up (footprint) area to the total plot area

(B) the ratio of the total floor area of all storeys to the plot area

(C) the ratio of the plot area to the abutting road width

(D) the ratio of the setback (open) area to the plot area

Q36. A statutory Master Plan (Development Plan) for a city is normally prepared as a long-range document with a perspective (horizon) period of about: **[2 marks]**

(A) 1 year

(B) 5 years

(C) 50 years

(D) 20 to 25 years

Q37. Under a "site-and-services" housing scheme for low-income families, the beneficiary is provided with: **[2 marks]**

(A) a fully finished, ready-to-occupy flat

(B) only a one-time cash subsidy with no land

(C) a serviced plot with basic infrastructure (water, sanitation, roads and power) on which the household builds the house incrementally

(D) shared rental barracks with no ownership

Q38. A residential neighbourhood accommodates a population of 12000 persons over a net residential area of 40 hectares. The net residential density of the neighbourhood is: **[2 marks]**

(A) 120 persons/ha

(B) 480 persons/ha

(C) 200 persons/ha

(D) 300 persons/ha

Q39. The principal purpose of land-use zoning in a statutory development plan is to: **[2 marks]**

(A) fix the property-tax rate for each plot

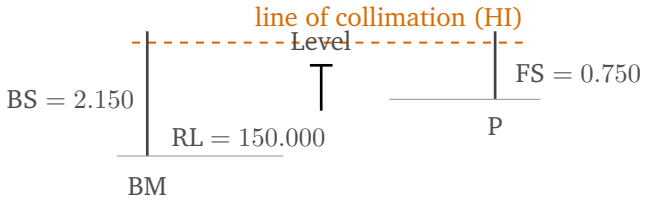
(B) prescribe the facade colours of buildings

(C) assign names to the streets of the city

(D) regulate the use of land by separating incompatible activities and controlling density and built form

Planning Techniques, Surveying and GIS

Q40. In differential levelling, a backsight of 2.150 m is taken on a benchmark of reduced level 150.000 m, and a foresight of 0.750 m is then taken on a point P, as shown. The reduced level of P is: **[2 marks]**



(A) 151.400 m

(B) 152.900 m

(C) 150.000 m

(D) 148.600 m

Q41. In the rise-and-fall method of reducing levels, if at a change point the foresight is numerically greater than the immediately preceding backsight, the difference between them represents a: **[2 marks]**

(A) rise

(B) fall

(C) zero change of level

(D) collimation (instrument) error

Q42. When a level field-book is reduced by the height-of-instrument (HI) method, the arithmetic check to be satisfied at the end of the work is: **[2 marks]**

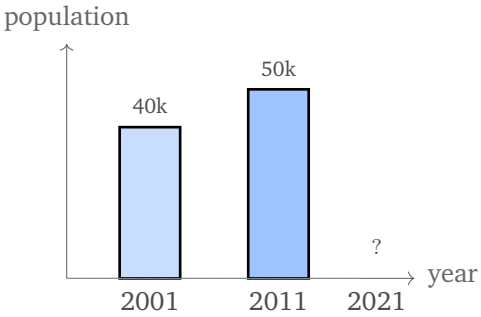
(A) $\Sigma\text{BS} + \Sigma\text{FS} = 0$

(B) $\Sigma BS - \Sigma FS = \Sigma Rise + \Sigma Fall$

(C) $\Sigma BS - \Sigma FS =$ (last RL) $-$ (first RL)

(D) $\Sigma FS - \Sigma BS =$ (last RL) $-$ (first RL)

Q43. A town's recorded population was $40{,}000$ in 2001 and $50{,}000$ in 2011, as shown. Using the *arithmetic increase* method of forecasting, the projected population for the year 2021 is: **[2 marks]**



(A) $62{,}500$

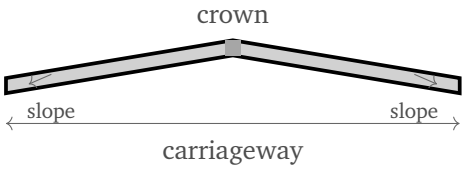
(B) $55{,}000$

(C) $45{,}000$

(D) $60{,}000$

Infrastructure, Services and Transportation Planning

Q44. In the road cross-section shown, the slight transverse slope given to the carriageway, falling from the crown at the centre down to the two edges so that rainwater drains off quickly, is called the: **[2 marks]**



(A) gradient (longitudinal slope)

(B) superelevation

(C) camber (cross slope)

(D) right-of-way

Q45. In traffic engineering, to analyse the capacity of a road carrying a mixed stream of cars, buses, trucks, two-wheelers and cycles, the different vehicle types are converted to one common unit called the: [2 marks]

(A) Passenger Car Unit (PCU)

(B) Annual Average Daily Traffic (AADT)

(C) Vehicle-kilometre (veh-km)

(D) Level of Service (LOS)

Q46. In the classical four-stage (four-step) urban transportation planning model, the "gravity model", which distributes trips between zones in proportion to their attractiveness and inversely with the travel impedance between them, is used chiefly in the stage of: [2 marks]

(A) trip generation

(B) trip distribution

(C) modal split

(D) traffic assignment

Detailed Solutions

Q1.

Solution

Concept – pioneers of organic architecture: Organic architecture treats a building as a natural extension of its site.

Step 1 – read the clues: The house is cantilevered dramatically over a waterfall and is called a masterwork of *organic* architecture.

Step 2 – recall the author: Fallingwater (1935) was designed by **Frank Lloyd Wright** for the Kaufmann family; its concrete trays reach out over Bear Run.

Why the other options are wrong:

- Louis Kahn is known for monumental masonry works (IIM Ahmedabad, Salk Institute), not Fallingwater.
- Alvar Aalto worked mainly in Finland; this is not his building.
- Le Corbusier authored the "Five Points" and the Villa Savoye, a very different idiom.

Final Answer: Frank Lloyd Wright $\Rightarrow$ B

Answer: (B) Go Back to Q1

Q2.

Solution

Concept – Louis Kahn's monumental civic works: Kahn used pure geometric masses and controlled daylight to give buildings a timeless, monumental character.

Step 1 – read the clues: The National Assembly at Dhaka has heavy geometric volumes cut by huge circular and triangular openings that filter light into the assembly chamber.

Step 2 – recall the author: This building (Jatiya Sangsad Bhaban) is the acknowledged masterpiece of **Louis Kahn**.

Why the other options are wrong:

- Le Corbusier designed Chandigarh's Capitol Complex, not Dhaka's assembly.
- B. V. Doshi and Charles Correa are major Indian modernists, but neither designed the Dhaka assembly.

Final Answer: Louis Kahn $\Rightarrow$ C

Answer: (C) Go Back to Q2

Q3.

Solution

Concept – Nordic organic modernism: The question points to a Finnish architect who softened the machine aesthetic with natural materials and human-scaled form.

Step 1 – read the clues: Undulating bent-timber furniture, the human-centred Paimio Sanatorium and the free-curved Savoy (Aalto) Vase.

Step 2 – recall the author: These are all works of **Alvar Aalto**, the leading figure of Finnish organic modernism.

Why the other options are wrong:

- Eliel Saarinen worked in the National Romantic style and later in the USA.
- Sverre Fehn was a later Norwegian architect.
- Arne Jacobsen was a Danish designer of a different, more austere modern idiom.

Final Answer: Alvar Aalto $\Rightarrow$ A

Answer: (A) Go Back to Q3

Q4.

Solution

Concept – naming the design philosophy: Several "isms" describe attitudes to form; here the key idea is unity with nature.

Step 1 – read the definition: A building that grows from its site and materials, so that form, structure and setting become a single harmonious whole.

Step 2 – name it: This is **organic architecture**, the philosophy most associated with Frank Lloyd Wright.

Why the other options are wrong:

- Brutalism emphasises raw exposed concrete and heavy monolithic form.
- Deconstructivism fragments and distorts geometry deliberately.
- Neoclassicism revives the columns and orders of classical antiquity.

Final Answer: Organic architecture $\Rightarrow$ A

Answer: (A) Go Back to Q4

Q5.

Solution

Concept – Kahn's ordering of space: Kahn distinguished the spaces people use from the spaces that service them.

Step 1 – read the definition: Major functional rooms are set apart from the ancillary stairs, ducts, toilets and shafts that support them.

Step 2 – name the concept: Kahn called these the **served** spaces and the **servant** spaces, gathering the servant elements into distinct pockets or towers.

Why the other options are wrong:

- The free plan is Le Corbusier's idea of a column-freed, flexible floor.
- Raumplan is Adolf Loos's split-level arrangement of volumes.
- Poché refers to the solid (pochéd) wall mass in a plan drawing, not this concept.

Final Answer: Servant and served spaces $\Rightarrow$ D

Answer: (D) Go Back to Q5

Q6.

Solution

Concept – iconic modern museums and their architects: The building is defined by a single continuous spiral ramp under a domed skylight.

Step 1 – read the clues: Galleries wind upward along one uninterrupted ramp within a great top-lit rotunda in New York.

Step 2 – recall the author: The Solomon R. Guggenheim Museum was designed by **Frank Lloyd Wright** (opened 1959).

Why the other options are wrong:

- Louis Kahn designed the Kimbell Art Museum, not the Guggenheim.
- Frank Gehry designed the later titanium-clad Guggenheim Bilbao, a different building.
- Mies van der Rohe is associated with steel-and-glass boxes such as the Seagram Building.

Final Answer: Frank Lloyd Wright $\Rightarrow$ B

Answer: (B) Go Back to Q6

Q7.

Solution

Concept – ordering principles of composition: Standard ordering devices include axis, symmetry, hierarchy, rhythm and datum.

Step 1 – read the figure: A single continuous line (the common base) gathers several separate elements of differing heights and holds them together.

Step 2 – name the device: A continuous line, plane or volume that binds a random collection of elements is a **datum**.

Why the other options are wrong:

- A node is a strategic point of focus, not an organising line.
- An axis is a line about which forms are arranged, usually implying symmetry across it, not simply a collecting base.
- A module is a repeating unit of measure, not an organising line.

Final Answer: Datum $\Rightarrow$ C

Answer: (C) Go Back to Q7

Q8.

Solution

Concept – Frank Lloyd Wright's early house types: Wright developed distinct house idioms at different stages of his career.

Step 1 – read the clues: Low horizontal massing, deep overhanging eaves, ribbon windows and open flowing plans, built in the Midwest around 1900–1917.

Step 2 – name the type: These are Wright's **Prairie houses** (for example the Robie House), inspired by the flat prairie landscape.

Why the other options are wrong:

- Usonian houses are Wright's later (1930s onward) affordable single-storey homes.
- Shingle style is an earlier east-coast American style, not Wright's Prairie work.

- Ranch houses are a later, popular post-war house type, not Wright's Prairie idiom.

Final Answer: Prairie houses $\Rightarrow$ B

Answer: (B) Go Back to Q8

Q9.

Solution

Concept – how composite materials work: A composite combines two phases: strong fibres to carry load and a matrix to bind and protect them.

Step 1 – describe FRP: Fibre-Reinforced Polymer consists of high-strength glass or carbon fibres set in a cured polymer (for example epoxy or polyester) resin.

Step 2 – explain the strength: The stiff fibres carry the tensile load while the matrix transfers stress between fibres and resists buckling, giving a very high strength-to-weight ratio.

Why the other options are wrong:

- There is no solid metallic core in FRP.
- Air voids are a defect that *weakens* a composite, not a source of strength.
- The polymer resin alone is weak; the fibres provide the strength.

Final Answer: high-strength fibres in a polymer matrix $\Rightarrow$ C

Answer: (C) Go Back to Q9

Q10.

Solution

Concept – surface treatment of aluminium: Aluminium forms a thin natural oxide film; a controlled process can thicken it.

Step 1 – name the process: Passing a current through the aluminium as the anode in an acid electrolyte grows a thick, hard, porous oxide layer. This is **anodising**.

Step 2 – note the benefits: The thickened oxide resists corrosion and abrasion, and its pores can be dyed and then sealed, so anodised aluminium is available in colours.

Why the other options are wrong:

- Galvanising is coating steel with zinc, not an aluminium oxide process.

- Tempering is a heat treatment for steel or glass.
- Vulcanising is the cross-linking of rubber with sulphur.

Final Answer: Anodising $\Rightarrow$ A

Answer: (A) Go Back to Q10

Q11.

Solution

Concept – the float-glass process: Modern flat glass is made flat by floating rather than rolling or drawing.

Step 1 – describe the process: Molten glass is poured continuously onto a bath of **molten tin**. Because tin is denser and the glass floats, both surfaces become perfectly flat and parallel.

Step 2 – explain the result: The ribbon then cools and hardens as it moves off the tin bath, giving distortion-free, transparent sheet glass.

Why the other options are wrong:

- Rolling between steel rollers gives patterned or wired glass, not optically flat sheet.
- Hand blowing into moulds is an old process for hollow and small pieces.
- Vertical drawing was the earlier sheet-glass method that the float process replaced because it left distortion.

Final Answer: floated on a bath of molten tin $\Rightarrow$ D

Answer: (D) Go Back to Q11

Q12.

Solution

Concept – expected time in PERT: PERT treats each activity duration as a random variable following a beta distribution with three time estimates.

Step 1 – write the weighted mean: The expected time weights the most likely value four times and the two extremes once each: $t_E = \dfrac{t_o + 4t_m + t_p}{6}$.

Step 2 – interpret the weights: The divisor $6 = 1+4+1$ is the sum of the weights, so t_E is a weighted average biased toward the most likely time.

Step 3 – note the related variance: For completeness, the activity variance is

$\left(\frac{t_p - t_o}{6}\right)^2$, though only the mean is asked here.

Why the other options are wrong:

- $(t_o + t_m + t_p)/3$ is a simple average that ignores the higher weight of t_m.
- $(t_o + 2t_m + t_p)/4$ uses the wrong weight on t_m.
- $(t_o + t_p)/2$ drops t_m altogether.

Final Answer: $t_E = (t_o + 4t_m + t_p)/6 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q12

Q13.

Solution

Concept – classifying walls by structural role: Walls are named by whether they carry load and how they are supported.

Step 1 – read the description: A lightweight external skin of aluminium framing and glass, hung from the floor slabs, carrying only its own weight and wind, transferring no floor load.

Step 2 – name it: Such a non-load-bearing hung envelope is a **curtain wall**.

Why the other options are wrong:

- A shear wall is a stiff structural wall that resists lateral (wind/seismic) forces, the opposite of a hung skin.
- A cavity wall is a masonry wall with an air gap, still often load bearing.
- A load-bearing wall carries floor and roof loads, which a curtain wall by definition does not.

Final Answer: Curtain wall $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q13

Q14.

Solution

Concept – volume of a rectangular slab: Volume of a rectangular prism = length $\times$ width $\times$ thickness.

Step 1 – list the dimensions: Length $= 2.0$ m, width $= 1.5$ m, thickness $= 0.4$ m.

Step 2 – multiply: $V = 2.0 \times 1.5 \times 0.4$.

Step 3 – evaluate step by step: $2.0 \times 1.5 = 3.0$ m^2 (the plan area). $3.0 \times 0.4 = 1.2$ m^3.

Why the other options are wrong:

- 3.0 m^3 is the plan area in m^2 mistaken for volume.
- 0.8 m^3 and 1.5 m^3 come from multiplying the wrong pair of dimensions.

Final Answer: 1.2 m^3 $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept – how laminated safety glass works: Safety glass is designed to hold together after breaking rather than fall as loose shards.

Step 1 – describe the build-up: Two or more glass plies are permanently bonded under heat and pressure to a tough, flexible plastic interlayer of **polyvinyl butyral (PVB)**.

Step 2 – explain the safety: On impact the glass cracks but the fragments stick to the PVB interlayer, so the pane stays in place and resists penetration.

Why the other options are wrong:

- Epoxy grout is a jointing/anchoring material, not a glazing interlayer.
- Molten tin is used in float-glass *manufacture*, not lamination.
- Sodium silicate (water glass) is an adhesive/sealant, not the standard laminating interlayer.

Final Answer: polyvinyl butyral (PVB) $\Rightarrow$ A

Answer: (A) Go Back to Q15

Q16.

Solution

Concept – maximum moment in a simply supported beam under UDL: For a full-span uniform load, the maximum bending moment occurs at midspan.

Step 1 – write the standard formula: $M_{\max} = \dfrac{wL^2}{8}$, where w is the load per unit

length and L the span.

Step 2 – substitute the values: $w = 12$ kN/m and $L = 8$ m, so $M_{\max} = \dfrac{12 \times 8^2}{8}$.

Step 3 – evaluate: $8^2 = 64$; $12 \times 64 = 768$; $768/8 = 96$.

Step 4 – state the result: $M_{\max} = 96$ kN·m at midspan.

Why the other options are wrong:

- 48 and 24 kN·m use wrong divisors ($wL^2/16$ or $wL^2/32$).
- 120 kN·m does not follow from $wL^2/8$.

Final Answer: 96 kN·m $\Rightarrow$ D

Answer: (D) Go Back to Q16

Q17.

Solution

Concept – distribution factor in moment distribution: When a moment is applied at a rigid joint, it is shared among the members in proportion to their stiffnesses.

Step 1 – define stiffness: The rotational stiffness of a member is $k = \dfrac{4EI}{L}$ (far end fixed), a measure of the moment needed for unit rotation.

Step 2 – write the distribution factor: For member i at a joint, $\text{DF}_i = \dfrac{k_i}{\sum k}$, the ratio of its stiffness to the sum of the stiffnesses of all members meeting there.

Step 3 – check the total: The distribution factors at any joint sum to 1, since the whole unbalanced moment is redistributed.

Why the other options are wrong:

- Length, load and cross-sectional area do not by themselves give the distribution factor; it is the stiffness ratio that governs.

Final Answer: stiffness of member / total stiffness at the joint $\Rightarrow$ A

Answer: (A) Go Back to Q17

Q18.

Solution

Concept – static indeterminacy of a plane frame: For a rigid-jointed plane frame the external static indeterminacy is the number of support reactions in excess of the three equations of equilibrium.

Step 1 – count the reactions: A fixed support in a plane provides 3 reactions (horizontal, vertical, moment). Two fixed bases give $R = 3 + 3 = 6$.

Step 2 – count the equilibrium equations: A plane structure has 3 equations of static equilibrium: $\Sigma F_x = 0$, $\Sigma F_y = 0$, $\Sigma M = 0$.

Step 3 – compute the degree of indeterminacy: For this closed single-bay portal (no internal hinges), $D_s = R - 3 = 6 - 3 = 3$.

Why the other options are wrong:

- 1 would apply to a propped cantilever, not a two-fixed-base portal.
- 0 is a just-stable (determinate) structure, which this is not.
- 6 is the number of reactions, not the excess over the three equations.

Final Answer: $3 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept – fixed-end moment for a central point load: A fixed-fixed beam develops restraining moments at both ends.

Step 1 – recall the standard result: For a beam fixed at both ends of span L carrying a central point load W, the fixed-end moment at each support is $M_F = \dfrac{WL}{8}$.

Step 2 – note the sign and symmetry: By symmetry the magnitudes at the two ends are equal; the value is $WL/8$ (hogging at the supports).

Why the other options are wrong:

- $WL/12$ is the fixed-end moment for a *uniformly distributed* load, a different loading.
- $WL/4$ is the mid-span moment of a *simply supported* beam with a central load.
- $WL/2$ has no standard basis here.

Final Answer: $\frac{WL}{8} \Rightarrow \boxed{D}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept – carry-over factor in moment distribution: When a moment is applied at the near end of a prismatic member with the far end fixed, part of it is "carried over" to the far end.

Step 1 – recall the standard value: For a prismatic (constant EI) member with the far end fixed, the carry-over factor is $\frac{1}{2}$.

Step 2 – interpret it: If a balancing moment M is applied at the near joint, a moment $\frac{M}{2}$ of the same sign appears at the fixed far end.

Why the other options are wrong:

- 1 would mean the full moment is transferred, which is not the case for a fixed far end.
- $1/4$ and $3/4$ are not the standard carry-over factor for a prismatic member.

Final Answer: $\frac{1}{2} \Rightarrow \boxed{D}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept – support moment of a cantilever under UDL: For a cantilever the maximum bending moment is at the fixed end.

Step 1 – find the total load: Total load $W = w \times L = 8 \times 3 = 24$ kN, acting as a resultant at the centroid of the load.

Step 2 – locate the resultant: The uniform load's resultant acts at midspan, i.e. at $\frac{L}{2} = \frac{3}{2} = 1.5$ m from the fixed end.

Step 3 – take moment about the fixed support: $M = W \times \frac{L}{2} = 24 \times 1.5 = 36$ kN·m.

Step 4 – check with the formula: $M = \frac{wL^2}{2} = \frac{8 \times 3^2}{2} = \frac{8 \times 9}{2} = \frac{72}{2} = 36$ kN·m, which agrees.

Why the other options are wrong:

- 24 kN·m is only the total load, not the moment.
- 72 kN·m omits the factor $\frac{1}{2}$ (that is wL^2).
- 12 kN·m uses $wL^2/6$, a wrong divisor.

Final Answer: 36 kN·m $\Rightarrow$ B

Answer: (B) Go Back to Q21

Q22.

Solution

Concept – solar altitude at solar noon: The noon altitude depends on the latitude and the sun's declination for the day.

Step 1 – write the noon-altitude formula: $\alpha = 90^\circ - |\,\phi - \delta\,|$, where ϕ is the latitude and δ the declination.

Step 2 – substitute the values: $\phi = 23.5^\circ$ N and $\delta = +23.5^\circ$ (summer solstice), so $\alpha = 90^\circ - |23.5^\circ - 23.5^\circ|$.

Step 3 – evaluate: $|23.5^\circ - 23.5^\circ| = 0^\circ$, hence $\alpha = 90^\circ - 0^\circ = 90^\circ$.

Step 4 – interpret: The noon sun is exactly overhead (at the zenith) on the Tropic of Cancer on the summer solstice.

Why the other options are wrong:

- 66.5° is the equinox noon altitude at this latitude $(90 - 23.5)$.
- 43° and 23.5° do not follow from the formula for this day.

Final Answer: $90^\circ \Rightarrow$ A

Answer: (A) Go Back to Q22

Q23.

Solution

Concept – sizing a horizontal overhang: A horizontal overhang shades a window when the sun's rays graze from the overhang edge down to the sill.

Step 1 – set up the geometry: Let the overhang project a horizontal distance d from the wall at the head of the window. The window height to be shaded is $h = 1.0$ m.

Step 2 – relate d and h through the altitude: The grazing ray makes the solar altitude α with the horizontal, so $\tan\alpha = \dfrac{h}{d}$, giving $d = \dfrac{h}{\tan\alpha}$.

Step 3 – substitute $\alpha = 45°$: $\tan 45° = 1$, so $d = \dfrac{1.0}{1} = 1.0$ m.

Step 4 – state the result: A 1.0 m projection just shades the full 1.0 m window at a $45°$ altitude.

Why the other options are wrong:

- 0.5 m would shade only half the window height at $45°$.
- 2.0 m and 1.5 m over-shade; they correspond to lower sun angles than $45°$.

Final Answer: 1.0 m $\Rightarrow$ C

Answer: (C) Go Back to Q23

Q24.

Solution

Concept – shadow angles for shading devices: Shading devices are described by the vertical shadow angle (VSA) and the horizontal shadow angle (HSA).

Step 1 – define the VSA: The vertical shadow angle is the angle measured on a vertical plane (the section) between the horizontal and the edge of the shadow; it governs how far a horizontal overhang must project.

Step 2 – match to the device: A plain horizontal overhang cuts off high-altitude sun and is therefore characterised chiefly by its **vertical shadow angle (VSA)**.

Why the other options are wrong:

- The horizontal shadow angle (HSA) governs *vertical* fins, which cut off sun coming from the side in plan.
- The azimuth alone or the declination alone does not describe the performance of the overhang.

Final Answer: vertical shadow angle (VSA) $\Rightarrow$ A

Answer: (A) Go Back to Q24

Q25.

Solution

Concept – Sabine's reverberation formula: Reverberation time relates room volume to total absorption.

Step 1 – write the formula: $\text{RT}_{60} = \dfrac{0.161\,V}{A}$, so the required absorption is $A = \dfrac{0.161\,V}{\text{RT}_{60}}$.

Step 2 – substitute the values: $V = 12000$ m^3 and $\text{RT}_{60} = 1.6$ s, so $A = \dfrac{0.161 \times 12000}{1.6}$.

Step 3 – evaluate the numerator: $0.161 \times 12000 = 1932$.

Step 4 – divide: $A = \dfrac{1932}{1.6} = 1207.5$ sabins.

Step 5 – round to the nearest option: $1207.5 \approx 1200$ sabins.

Why the other options are wrong:

- 600 and 300 sabins would give reverberation times far longer than 1.6 s.
- 2400 sabins would give about half the target reverberation time.

Final Answer: ≈ 1200 sabins $\Rightarrow$ B

Answer: (B) Go Back to Q25

Q26.

Solution

Concept – solar declination through the year: Declination is the angle of the sun's rays relative to the equatorial plane; it varies between $+23.5°$ and $-23.5°$ over the year.

Step 1 – recall the equinox condition: On the equinoxes the sun is directly over the equator, so its rays are parallel to the equatorial plane.

Step 2 – state the declination: This makes the declination $\delta = 0°$ on both equinox days.

Step 3 – cross-check the symptoms: With $\delta = 0°$, the sun rises due east, sets due west, and day and night are equal everywhere, exactly as described.

Why the other options are wrong:

- $+23.5°$ is the summer solstice value.
- $-23.5°$ is the winter solstice value.
- $+11.75°$ is an intermediate value, not the equinox declination.

Final Answer: $0^\circ \Rightarrow$ C

Answer: (C) Go Back to Q26

Q27.

Solution

Concept – units of the U-value: The U-value is a rate of heat flow per unit area per unit temperature difference.

Step 1 – write the defining relation: Heat flow $Q = U \times A \times \Delta T$, where Q is in watts (W), A in m^2 and ΔT in kelvin (K).

Step 2 – rearrange for U: $U = \dfrac{Q}{A\,\Delta T}$, so the units are $\dfrac{\text{W}}{\text{m}^2 \cdot \text{K}}$.

Step 3 – state the result: The U-value is expressed in $\text{W/m}^2 \cdot \text{K}$.

Why the other options are wrong:

- $\text{W/m} \cdot \text{K}$ is the unit of thermal *conductivity* k, a material property.
- W/K is overall conductance without the per-area term.
- $\text{J/kg} \cdot \text{K}$ is the unit of specific heat capacity.

Final Answer: $\text{W/m}^2 \cdot \text{K} \Rightarrow$ B

Answer: (B) Go Back to Q27

Q28.

Solution

Concept – the daylight factor: The daylight factor expresses interior daylight as a fraction of the available exterior daylight.

Step 1 – write the definition: $\text{DF} = \dfrac{E_{\text{indoor}}}{E_{\text{outdoor}}} \times 100\%$, where both illuminances are measured at the same instant under a standard overcast sky.

Step 2 – explain each term: E_{indoor} is the illuminance at the point inside, and E_{outdoor} is the simultaneous illuminance on a horizontal plane under an unobstructed overcast sky.

Step 3 – note why overcast sky is used: An overcast sky gives a predictable luminance distribution, so the ratio is independent of the changing sun position.

Why the other options are wrong:

- The ratio of direct sun to diffuse skylight is not the daylight factor.

- Window-area to floor-area is a simple rule of thumb, not the daylight factor.
- Lamp lumens to floor area concerns *artificial* lighting, not daylight.

Final Answer: indoor/outdoor illuminance under overcast sky, as a percentage ⇒ C

Answer: (C) Go Back to Q28

Q29.

Solution

Concept – lively streets in urban design: The character of a street depends strongly on what happens at its ground-floor edge.

Step 1 – read the description: Ground floors lined with shops, entrances, display windows and visible activity that engage the pedestrian.

Step 2 – name the quality: This is an **active (lively) street frontage**, which supports walkability, natural surveillance and street life.

Why the other options are wrong:

- A deep front setback pushes buildings back and usually deadens the street edge.
- A landscaped buffer strip separates uses but does not by itself animate the frontage.
- A gated frontage closes the edge to the public, the opposite of an active frontage.

Final Answer: active (lively) street frontage ⇒ B

Answer: (B) Go Back to Q29

Q30.

Solution

Concept – landscape design techniques: Traditional garden design has specific devices for handling views and space.

Step 1 – read the description: A distant feature outside the site is captured and made to read as part of the garden composition.

Step 2 – name the technique: This is **borrowed landscape** (the Japanese *shakkei*), which frames and incorporates an external view.

Why the other options are wrong:

- Topiary is the clipping of shrubs into ornamental shapes.
- A parterre is a formal, level bed of clipped hedges arranged in patterns.
- A pergola is a built framework carrying climbing plants, not a view technique.

Final Answer: borrowed landscape (shakkei) $\Rightarrow$ C

Answer: (C) Go Back to Q30

Q31.

Solution

Concept – the height-to-width ratio of a street: The H/W ratio measures how tightly a street or square is enclosed by its flanking buildings.

Step 1 – read the figure: Buildings of height H line both sides of a space of width W.

Step 2 – interpret the ratio: A larger H/W makes the street feel more enclosed and canyon-like; a smaller H/W feels open. So H/W measures the **sense of spatial enclosure**.

Step 3 – note typical values: Comfortable urban streets often have H/W roughly between $1:1$ and $1:2$.

Why the other options are wrong:

- Floor area ratio compares total floor area to plot area, not building height to street width.
- Ground coverage is the footprint-to-plot ratio.
- Population density is persons per unit area, unrelated to H/W.

Final Answer: sense of spatial enclosure $\Rightarrow$ A

Answer: (A) Go Back to Q31

Q32.

Solution

Concept – linear open-space systems: Cities use several kinds of linear public spaces.

Step 1 – read the description: A linear open space along a river, ridge or old rail line, used for recreation and walking/cycling, linking parks together.

Step 2 – name it: This is a **greenway**, a continuous linear green corridor for people and, often, wildlife.

Why the other options are wrong:

- A boulevard is a wide, tree-lined *road* for traffic, not primarily a recreational corridor.
- A cul-de-sac is a dead-end residential street.
- An esplanade is a level promenade, usually along a seafront, not a park-linking corridor.

Final Answer: greenway $\Rightarrow$ B

Answer: (B) Go Back to Q32

Q33.

Solution

Concept – functional roles of planting: Plants in landscape design serve architectural, engineering, climatic and aesthetic functions.

Step 1 – read the intent: A dense row of tall planting is placed specifically to block an ugly view or hide a service yard.

Step 2 – name the function: Using vegetation as a visual barrier is **screening**.

Why the other options are wrong:

- An accent uses a single striking plant as a focal point, the opposite of hiding something.
- Framing a view uses planting to *reveal* and enhance a good view, not to block a bad one.
- Ground cover is low spreading planting to protect the soil surface.

Final Answer: screening $\Rightarrow$ C

Answer: (C) Go Back to Q33

Q34.

Solution

Concept – FAR, ground coverage and number of floors: FAR fixes the total floor area; ground coverage fixes the footprint; their combination fixes the floor count.

Step 1 – find the maximum built-up (floor) area: Built-up area $=$ FAR $\times$ plot area $= 2.0 \times 800 = 1600$ m^2.

Step 2 – find the maximum footprint from ground coverage: Footprint $= 40\% \times 800 = 0.40 \times 800 = 320$ m^2.

Step 3 – find the number of floors: Number of floors $= \dfrac{\text{built-up area}}{\text{footprint}} = \dfrac{1600}{320} = 5$.

Step 4 – state the result: Maximum built-up area $= 1600$ m^2, achieved over 5 floors of 320 m^2 each.

Why the other options are wrong:

- 1600 m^2 with 2 floors would need a 800 m^2 footprint, exceeding the 40% coverage limit.
- 320 m^2 is only the footprint, not the total built-up area.
- 800 m^2 ignores the FAR of 2.0.

Final Answer: 1600 m^2 built-up, 5 floors $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q34

Q35.

Solution

Concept – ground coverage versus FAR: Ground coverage controls the footprint; FAR controls the total floor area.

Step 1 – write the definition: Ground coverage $= \dfrac{\text{ground-floor built-up (footprint) area}}{\text{total plot area}}$, usually expressed as a percentage.

Step 2 – distinguish from FAR: FAR sums the floor area of *all* storeys, whereas ground coverage counts only the footprint at ground level.

Why the other options are wrong:

- Total floor area of all storeys to plot area is the definition of FAR/FSI, not ground coverage.
- Plot area to road width and setback area to plot area are not ground coverage.

Final Answer: ground-floor footprint area / plot area $\Rightarrow$ A

Answer: (A) Go Back to Q35

Q36.

Solution

Concept – the horizon of a Master Plan: A Master Plan is a long-range, perspective document rather than a short-term programme.

Step 1 – recall the standard period: Statutory Master (Development) Plans in India are generally prepared for a perspective of about **20 to 25 years**.

Step 2 – note the periodic review: The plan is reviewed and revised periodically (often every 5 years) within this longer horizon.

Why the other options are wrong:

- 1 year and 5 years describe annual plans or review cycles, not the plan horizon.
- 50 years is far longer than the usual statutory perspective period.

Final Answer: 20 to 25 years $\Rightarrow$ D

Answer: (D) Go Back to Q36

Q37.

Solution

Concept – the site-and-services approach to housing: This approach provides the serviced land and lets the household build the house over time.

Step 1 – read what is provided: A demarcated plot with basic infrastructure: water supply, sanitation, access roads and power.

Step 2 – read what the beneficiary does: The family constructs and expands the dwelling itself, incrementally, as resources allow.

Step 3 – note the rationale: It lowers cost, uses self-help and suits low-income groups better than a fully built, more expensive unit.

Why the other options are wrong:

- A fully finished flat is the opposite of the incremental self-build idea.
- A cash subsidy with no land is not a site-and-services scheme.
- Shared rental barracks provide no plot or ownership.

Final Answer: a serviced plot on which the household builds incrementally $\Rightarrow$ C

Answer: (C) Go Back to Q37

Q38.

Solution

Concept – net residential density: Density is population divided by the area it occupies.

Step 1 – write the formula: Net residential density $= \dfrac{\text{population}}{\text{net residential area}}$.

Step 2 – substitute the values: Population $= 12000$ persons; net residential area $= 40$ ha.

Step 3 – divide: Density $= \dfrac{12000}{40} = 300$ persons/ha.

Why the other options are wrong:

- 120 persons/ha would need an area of 100 ha, not 40 ha.
- 480 persons/ha would need only 25 ha.
- 200 persons/ha would need 60 ha.

Final Answer: 300 persons/ha $\Rightarrow$ D

Answer: (D) Go Back to Q38

Q39.

Solution

Concept – the purpose of land-use zoning: Zoning is the statutory tool that governs how land may be used and developed.

Step 1 – read the core aim: Zoning divides the city into zones (residential, commercial, industrial, etc.) so that incompatible activities are kept apart.

Step 2 – add the control of intensity: Within each zone it also regulates density and built form through FAR, ground coverage, height and setbacks.

Step 3 – state the purpose: Hence zoning regulates the use of land by separating incompatible activities and controlling density and built form.

Why the other options are wrong:

- Fixing tax rates, prescribing facade colours and naming streets are not the purpose of zoning.

Final Answer: separating incompatible uses and controlling density/built form $\Rightarrow$ D

Answer: (D) Go Back to Q39

Q40.

Solution

Concept – reduced level by the height-of-instrument method: The instrument height (HI) is found from a known point, then applied to the unknown point.

Step 1 – compute the height of instrument: HI = RL of BM + BS = $150.000 + 2.150 = 152.150$ m.

Step 2 – apply the foresight to find RL of P: RL of P = HI − FS = $152.150 - 0.750$.

Step 3 – evaluate: $152.150 - 0.750 = 151.400$ m.

Step 4 – sense check: Since the foresight (0.750) is smaller than the backsight (2.150), point P is higher than the benchmark, and indeed $151.400 > 150.000$.

Why the other options are wrong:

- 152.900 m wrongly adds the foresight instead of subtracting it.
- 150.000 m is the benchmark level, ignoring the rise.
- 148.600 m subtracts both readings, which is incorrect.

Final Answer: 151.400 m $\Rightarrow$ A

Answer: (A) Go Back to Q40

Q41.

Solution

Concept – rise and fall in levelling: Comparing successive staff readings tells whether the ground rose or fell.

Step 1 – state the rule: A higher staff reading means the point is lower. So if the later reading (foresight) is greater than the earlier reading (backsight), the point has gone *down*.

Step 2 – classify the difference: Foresight $>$ backsight $\Rightarrow$ the difference is a **fall**.

Step 3 – contrast: If instead the later reading were smaller, the difference would be a *rise*.

Why the other options are wrong:

- A rise occurs when the later reading is *smaller*, the opposite case.
- Zero change needs equal readings.
- A collimation error is an instrument fault, not read from a single rise/fall comparison.

Final Answer: fall $\Rightarrow$ B

Answer: (B) Go Back to Q41

Q42.

Solution

Concept – arithmetic check in the HI method: The check confirms that the reductions are internally consistent.

Step 1 – recall the check for the HI method: $\Sigma\text{BS} - \Sigma\text{FS} = (\text{last RL}) - (\text{first RL})$.

Step 2 – interpret it: The net of all backsights minus all foresights must equal the overall change in level from the first to the last point.

Step 3 – note the rise-and-fall variant: In the rise-and-fall method a fuller check also requires $\Sigma\text{BS} - \Sigma\text{FS} = \Sigma\text{Rise} - \Sigma\text{Fall} = \text{last RL} - \text{first RL}$, but the HI-method check asked here is the first relation.

Why the other options are wrong:

- $\Sigma\text{BS} + \Sigma\text{FS} = 0$ is impossible for positive staff readings.
- $\Sigma\text{BS} - \Sigma\text{FS} = \Sigma\text{Rise} + \Sigma\text{Fall}$ wrongly adds rise and fall instead of taking their difference.
- $\Sigma\text{FS} - \Sigma\text{BS} = \text{last RL} - \text{first RL}$ has the sign reversed.

Final Answer: $\Sigma\text{BS} - \Sigma\text{FS} = \text{last RL} - \text{first RL} \Rightarrow$ C

Answer: (C) Go Back to Q42

Q43.

Solution

Concept – arithmetic increase method of population forecasting: This method assumes the population grows by a *constant absolute amount* each decade.

Step 1 – find the decadal increase: Increase from 2001 to 2011 $= 50000 - 40000 = 10000$ persons per decade.

Step 2 – apply the constant increment for the next decade: Projected 2021

population $= 50000 + 10000 = 60000$ persons.

Step 3 – contrast with the geometric method: The geometric (constant-percentage) method would give $50000 \times 1.25 = 62500$, which is the trap option A. The arithmetic method uses the constant *amount*, giving 60000.

Why the other options are wrong:

- 62500 is the *geometric* increase result, not arithmetic.
- 55000 uses only half the decadal increment.
- 45000 wrongly decreases the population.

Final Answer: $60000 \Rightarrow$ D

Answer: (D) Go Back to Q43

Q44.

Solution

Concept – transverse slope of a carriageway: Road surfaces are shaped so that rainwater sheds sideways to the drains.

Step 1 – read the figure: The surface is highest at the central crown and slopes gently down to both edges.

Step 2 – name the slope: This transverse (cross) slope from crown to edge is the **camber** (or cross slope), provided to drain surface water quickly.

Why the other options are wrong:

- Gradient is the *longitudinal* slope along the length of the road, not across it.
- Superelevation is the transverse slope raised toward the outer edge specifically on a horizontal *curve* to counter centrifugal force, not the everyday crown-to-edge camber on a straight road.
- Right-of-way is the total reserved land width, not a slope.

Final Answer: camber (cross slope) $\Rightarrow$ C

Answer: (C) Go Back to Q44

Q45.

Solution

Concept – equivalencing a mixed traffic stream: Different vehicles occupy different road space and move at different speeds, so capacity is measured in a common unit.

Step 1 – name the unit: Each vehicle type is converted to an equivalent number of cars using the **Passenger Car Unit (PCU)**.

Step 2 – illustrate: For example a car is 1 PCU, while a bus or truck may be 3 PCU and a bicycle a fraction of a PCU, reflecting the road space each takes.

Why the other options are wrong:

- AADT is a traffic *volume* count, not an equivalency factor between vehicle types.
- Vehicle-kilometre measures travel amount, not vehicle equivalence.
- Level of Service grades traffic *quality*, it does not convert vehicle types.

Final Answer: Passenger Car Unit (PCU) $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q45

Q46.

Solution

Concept – the four-step transport model: The sequence is trip generation $\rightarrow$ trip distribution $\rightarrow$ modal split $\rightarrow$ traffic assignment.

Step 1 – recall the gravity model: The gravity model estimates the number of trips between each pair of zones in proportion to the zones' trip ends and inversely with the travel impedance (distance, time or cost) between them.

Step 2 – match to the stage: Because it links origins to destinations ("from where to where"), the gravity model belongs to the **trip distribution** stage.

Why the other options are wrong:

- Trip generation only counts trip ends per zone; it does not pair zones.
- Modal split allocates trips among transport modes.
- Traffic assignment loads the distributed trips onto specific network routes.

Final Answer: trip distribution $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q46

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	A	5	D
6	B	7	C	8	B	9	C	10	A
11	D	12	A	13	D	14	B	15	A
16	D	17	A	18	B	19	D	20	D
21	B	22	A	23	C	24	A	25	B
26	C	27	B	28	C	29	B	30	C
31	A	32	B	33	C	34	D	35	A
36	D	37	C	38	D	39	D	40	A
41	B	42	C	43	D	44	C	45	A
46	B								