GATE Architecture and Planning

Sample Paper – 3

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. The German Pavilion built for the 1929 Barcelona International Exposition, an icon of the Modern Movement famous for its flowing open plan, richly veined marble planes and slender cruciform chromed-steel columns, was designed by: [1 mark]

(A) Walter Gropius

(B) Mies van der Rohe

(C) Alvar Aalto

(D) Le Corbusier

Q2. The 1933 meeting of the Congrès Internationaux d'Architecture Moderne (CIAM) produced an influential urban-planning manifesto that classified the functions of the city into dwelling, work, recreation and circulation. This manifesto is known as the: **[1 mark]**

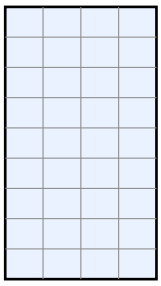
(A) Bauhaus Manifesto

(B) Charter of Machu Picchu

(C) Athens Charter

(D) Garden City Manifesto

Q3. The tall office building shown, wrapped in a uniform repetitive grid of glass and steel with no applied ornament, a flat roof and an expressed structural frame, exemplifies the mid-twentieth-century aesthetic known as the: **[1 mark]**



glass-and-steel tower

(A) Art Nouveau

(B) Gothic Revival

(C) International Style

(D) Baroque

Q4. The minimalist aphorism most closely associated with Mies van der Rohe, expressing the reductive ethos of the Modern Movement, is: **[1 mark]**

(A) "Less is more"

(B) "Form follows function"

(C) "Ornament is crime"

(D) “Less is a bore”

Q5. The dictum “Form follows function”, asserting that the shape of a building should be based primarily on its intended purpose, was coined by the American architect: **[1 mark]**

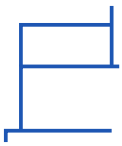
(A) Frank Lloyd Wright

(B) Louis Sullivan

(C) Philip Johnson

(D) Daniel Burnham

Q6. The tubular steel cantilever furniture developed at the Bauhaus, such as the “Wassily” chair sketched below, which exploits the spring action of a continuous bent steel tube, is credited to: **[1 mark]**



cantilever tubular-steel chair

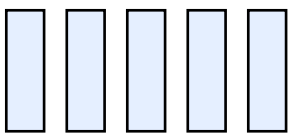
(A) Le Corbusier

(B) Charles Eames

(C) Marcel Breuer

(D) Eero Saarinen

Q7. In architectural composition, the regular repetition of identical elements at equal spacing, such as the row of equal bays shown below, is the ordering principle called: **[1 mark]**



equal elements at equal spacing

(A) Rhythm

(B) Symmetry

(C) Hierarchy

(D) Datum

Q8. The three fundamental qualities that a work of architecture should possess according to the Roman writer Vitruvius – *firmitas*, *utilitas* and *venustas* – correspond respectively to: [1 mark]

(A) firmness (strength), commodity (usefulness) and delight (beauty)

(B) light, air and open space

(C) proportion, symmetry and rhythm

(D) cost, time and quality

Building Construction, Materials and Management

Q9. In modern building envelopes, a "curtain wall" is best described as: [1 mark]

(A) a load-bearing masonry wall that carries the floor loads above it

(B) an internal partition wall dividing rooms

(C) a retaining wall holding back earth on a sloping site

(D) a non-load-bearing external cladding that carries only its own weight and wind load, hung from the building frame

Q10. In a stick-system aluminium-and-glass curtain wall, the horizontal framing members that span between the vertical mullions are called: [1 mark]

(A) mullions

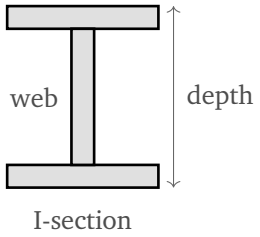
(B) purlins

(C) spandrels

(D) transoms

Q11. The hot-rolled structural steel section shown in cross-section, with most of its material concentrated in the two flanges far from the neutral axis

so as to give a high moment of inertia for use as a beam, is designated in Indian practice as an: [1 mark]



I-section

(A) angle section

(B) channel section

(C) I-section (ISMB)

(D) flat plate

Q12. In the Programme Evaluation and Review Technique (PERT), the expected time t_e of an activity is obtained from the optimistic time t_o, the most likely time t_m and the pessimistic time t_p by the relation: [1 mark]

(A) $t_e = \dfrac{t_o + t_m + t_p}{3}$

(B) $t_e = \dfrac{t_o + 4\,t_m + t_p}{6}$

(C) $t_e = \dfrac{t_o + t_p}{2}$

(D) $t_e = \dfrac{t_o + 2\,t_m + t_p}{4}$

Q13. In the manufacture of modern flat glass (the float process), the molten glass is drawn continuously over a bath of a molten metal so that it spreads out with perfectly flat, parallel, distortion-free surfaces. The metal used in this bath is: [1 mark]

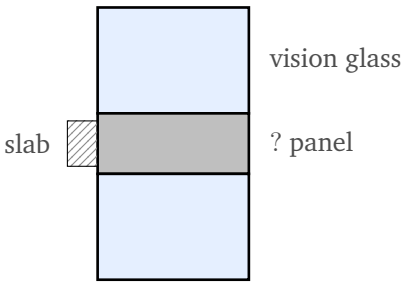
(A) tin

(B) lead

(C) zinc

(D) mercury

Q14. In the curtain-wall section shown, the opaque insulated panel that conceals the edge of the floor slab and fills the zone between the head of one vision window and the sill of the window above is called the: **[1 mark]**



(A) transom panel

(B) vision glass

(C) spandrel panel

(D) mullion cap

Q15. A project-management chart that displays each activity as a horizontal bar drawn against a time scale, showing its start, duration and finish, is known as a: **[1 mark]**

(A) mass-haul diagram

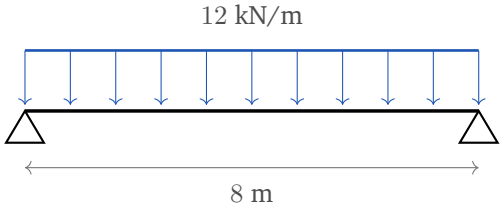
(B) Gantt (bar) chart

(C) histogram

(D) pie chart

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, occurring at midspan and equal to $wL^2/8$, is: **[1 mark]**



(A) 48 kN·m

(B) 120 kN·m

(C) 12 kN·m

(D) 96 kN·m

Q17. In the limit-state design of reinforced concrete to IS 456, the partial safety factor applied to the characteristic load combination of dead load plus imposed (live) load at the ultimate limit state of collapse is: **[1 mark]**

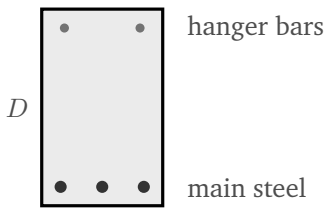
(A) 1.0

(B) 1.15

(C) 1.25

(D) 1.5

Q18. In a reinforced concrete beam subjected to sagging (positive) bending, the main longitudinal tension reinforcement, shown as the larger bars in the section below, is correctly placed: **[1 mark]**



(A) near the bottom face, where the flexural tension occurs

(B) near the top face

(C) exactly at the neutral axis

(D) uniformly around the whole perimeter

Q19. For M25-grade concrete, the characteristic compressive strength measured on a 150 mm cube at 28 days is: **[1 mark]**

(A) 25 N/mm^2

(B) 15 N/mm^2

(C) 30 N/mm^2

(D) 20 N/mm^2

Q20. As per IS 456, the short-term static modulus of elasticity of concrete is estimated as $E_c = 5000\sqrt{f_{ck}}$ N/mm^2, where f_{ck} is in N/mm^2. For M25 concrete the value of E_c is nearest to: **[1 mark]**

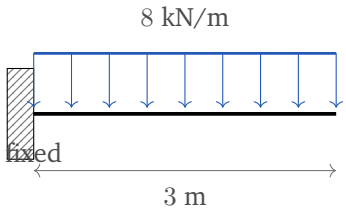
(A) 5000 N/mm^2

(B) 12500 N/mm^2

(C) 50000 N/mm^2

(D) 25000 N/mm^2

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



(A) 36 kN·m

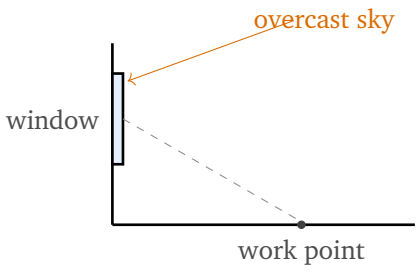
(B) 18 kN·m

(C) 12 kN·m

(D) 72 kN·m

Environmental Design and Building Services

Q22. The "daylight factor" at a point inside a room, illustrated in the section below, is defined as the ratio of: **[2 marks]**



(A) direct sunlight to diffuse skylight received at that point

(B) illuminance on a vertical surface to that on a horizontal surface

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

(D) window area to floor area of the room

Q23. At a work point the indoor illuminance under an overcast sky is measured as 250 lux while the simultaneous unobstructed outdoor horizontal illuminance is 10000 lux. The daylight factor at the point is: **[2 marks]**

(A) 25%

(B) 2.5%

(C) 0.25%

(D) 40%

Q24. The daylight factor at an interior point is made up of three components. Two of them are the *sky component* and the *externally reflected component*. The third component is the: **[2 marks]**

(A) direct sunlight component

(B) glare component

(C) artificial-light component

(D) internally reflected component

Q25. The overall thermal transmittance (the U-value) of a building element such as a wall or roof, which measures the rate of heat flow through it per unit area per unit temperature difference, is expressed in the units: **[2 marks]**

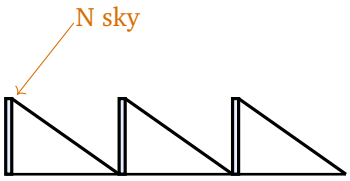
(A) W/m^2

(B) $W \cdot m/K$

(C) $W/(m^2 \cdot K)$

(D) W/K

Q26. The saw-tooth (north-light) factory roof shown in section is oriented with its glazed faces toward the north (in the northern hemisphere) mainly so as to: **[2 marks]**



north-light (saw-tooth) roof

(A) admit the maximum amount of direct summer sun

(B) collect and store rainwater on the roof

(C) reduce the required structural span

(D) admit steady, glare-free diffuse north-sky daylight while keeping direct sun and heat out

Q27. The logarithmic unit used to express the level of sound intensity or sound pressure relative to a fixed reference value is the: **[2 marks]**

(A) lux

(B) lumen

(C) decibel (dB)

(D) candela

Q28. In a building's electrical installation, the protective device that continuously compares the currents in the live and neutral conductors and trips the circuit within milliseconds when it senses a small leakage of current to earth, so as to protect people from electric shock, is the: **[2 marks]**

(A) earth-leakage circuit breaker (ELCB / RCCB)

(B) miniature circuit breaker sized only for overload

(C) manual isolator switch

(D) power-factor capacitor bank

Urban Design and Landscape Architecture

Q29. In Kevin Lynch's analysis of city form, the quality he called "imageability" (or legibility) of a city refers to: **[2 marks]**

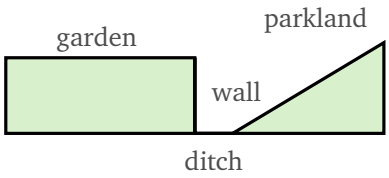
(A) the market value of its land

(B) the ease with which its parts can be recognised and organised by an observer into a coherent mental image

(C) the density of its road network per square kilometre

(D) the total built-up floor area within its limits

Q30. In landscape design, the device shown in section – a sunken ditch with a retaining wall on the garden side – that keeps grazing animals out yet preserves an uninterrupted view from the garden into the parkland beyond, is called a: **[2 marks]**



(A) ha-ha

(B) pergola

(C) parterre

(D) topiary

Q31. A landscaped linear open space, often following a river bank or a disused railway alignment, that links parks together and provides a continuous route for walking and cycling, is called a: **[2 marks]**

(A) cul-de-sac

(B) plaza

(C) atrium

(D) greenway

Q32. In Camillo Sitte's study of good civic design, the enclosed, hard-paved public open space at the heart of a European town, framed on its sides by continuous building facades, is the: **[2 marks]**

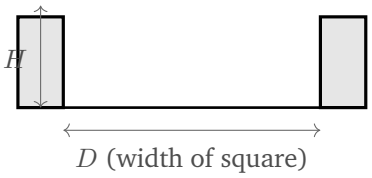
(A) boulevard

(B) greenbelt

(C) cul-de-sac

(D) piazza (town square)

Q33. For a comfortable sense of enclosure in an urban square, designers commonly aim for a ratio of the surrounding building height H to the width D of the square, as marked below, of about: **[2 marks]**



(A) $1:10$ (the height a tenth of the width)

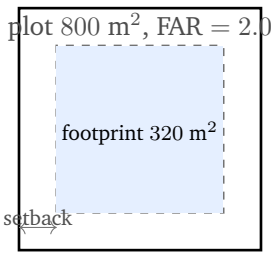
(B) $1:3$ to $1:4$ (the width three to four times the height)

(C) $3:1$ (the height three times the width)

(D) $1:20$ (the height a twentieth of the width)

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. If setbacks restrict the ground-floor footprint of the building to 320 m^2, as shown, the maximum number of equal floors that can be built is: **[2 marks]**



(A) 2 floors

(B) 5 floors

(C) 8 floors

(D) 4 floors

Q35. In Clarence Perry's "Neighbourhood Unit" concept, the physical size (population and area) of the unit is fixed primarily by: [2 marks]

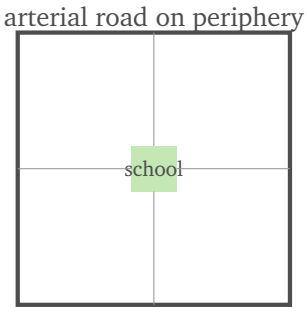
(A) the maximum permitted height of the buildings

(B) the catchment area of a district general hospital

(C) the population required to support one elementary school, kept within an easy walking radius of about 400 m

(D) the length of the water-supply trunk main

Q36. According to the principles of Perry's Neighbourhood Unit, illustrated in the schematic plan below, the arterial through-traffic streets should be located: [2 marks]



(A) running straight through the centre of the unit past the school

(B) on the periphery (boundaries) of the unit, with narrow internal streets that discourage through-traffic

(C) diagonally across the unit from corner to corner

(D) entirely underground beneath the unit

Q37. The Radburn layout (New Jersey, 1929) by Clarence Stein and Henry Wright is best remembered for introducing: [2 marks]

(A) the high-rise residential tower block

(B) the "superblock" with complete separation of pedestrian and vehicular movement and houses grouped around cul-de-sacs

(C) the linear "ribbon" city stretched along a highway

(D) the rigid gridiron street pattern

Q38. A housing scheme accommodates 3600 persons on a net residential area of 12 hectares. The net residential density of the scheme is: **[2 marks]**

(A) 100 persons/ha

(B) 200 persons/ha

(C) 360 persons/ha

(D) 300 persons/ha

Q39. In the measurement of dwelling-unit areas, the "carpet area" of a flat refers to: **[2 marks]**

(A) the plinth area measured to the outer face of the external walls

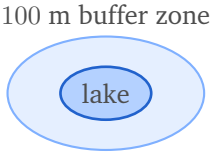
(B) the net usable floor area available within the walls of the unit, excluding the thickness of the walls

(C) the total built-up area including balconies, walls and a share of common areas

(D) the area of the plot on which the building stands

Planning Techniques, Surveying and GIS

Q40. In a Geographic Information System, the operation that generates a new zone of a specified distance around a point, line or polygon feature – for example the 100 m protection zone drawn around the lake below – is called a: **[2 marks]**



(A) overlay

(B) geocoding

(C) interpolation

(D) buffer

Q41. In GIS-based land-suitability analysis, several thematic layers (for example slope, land use, soil and distance from a road) are superimposed on one another so that areas satisfying all the criteria together can be identified. This operation is called: [2 marks]

(A) overlay analysis

(B) buffering

(C) on-screen digitising

(D) rubber-sheeting

Q42. An Electronic Distance Measurement (EDM) instrument determines the distance from the instrument to a reflecting prism by: [2 marks]

(A) counting the number of paces walked between the two points

(B) stretching a graduated metallic chain along the ground

(C) measuring the travel time or phase shift of a modulated electromagnetic (light or microwave) wave sent to the prism and reflected back

(D) reading a graduated levelling staff held at the far point

Q43. A "total station", the standard instrument of modern engineering surveys, is best described as an instrument that combines: [2 marks]

(A) a dumpy level and a metric chain

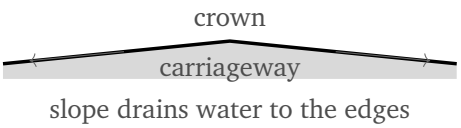
(B) a plane table and an alidade

(C) an electronic theodolite for measuring angles with an EDM for measuring distances and an on-board processor and data logger

(D) a hand-held GPS receiver and an aneroid barometer

Infrastructure, Services and Transportation Planning

Q44. In the road cross-section shown, the gentle transverse slope given to the carriageway from its raised centre-line (crown) down towards each edge, provided so that rainwater drains quickly off the pavement, is called the: **[2 marks]**



(A) superelevation

(B) camber (cross-fall)

(C) longitudinal gradient

(D) right-of-way

Q45. The raising of the outer edge of a carriageway relative to its inner edge on a horizontal curve, provided so that the resultant of the vehicle's weight and the centrifugal force stays roughly perpendicular to the road surface, is called: **[2 marks]**

(A) superelevation

(B) camber

(C) stopping sight distance

(D) kerb height

Q46. In a "separate" system of sewerage, the domestic sanitary sewage and the storm-water runoff are carried: **[2 marks]**

(A) in two entirely independent pipe networks, one for sewage and one for storm water

(B) together in a single combined pipe at all times

(C) only in open surface drains along the roadside

(D) in the same pipe but released at different times of day

Detailed Solutions

Q1.

Solution

Concept – the icons of the Modern Movement and their authors: Each pioneer of the Modern Movement is tied to a small set of signature buildings.

Step 1 – read the clues in the description: A single-storey pavilion with a free, flowing open plan; walls of richly veined marble and travertine treated as independent planes; and slender chromed cruciform steel columns supporting a thin flat roof.

Step 2 – match to the architect: These are the exact hallmarks of the Barcelona Pavilion, the built demonstration of "less is more", designed by **Mies van der Rohe** (with Lilly Reich).

Why the other options are wrong:

- Walter Gropius founded the Bauhaus but did not design the Barcelona Pavilion.
- Alvar Aalto was a Finnish modernist known for organic timber and brick works, not this steel-and-marble pavilion.
- Le Corbusier designed the Villa Savoye and the Unité d'Habitation, a different idiom of white concrete forms.

Final Answer: Mies van der Rohe $\Rightarrow$ B

Answer: (B) Go Back to Q1

Q2.

Solution

Concept – CIAM and the functional city: CIAM was the international forum through which the Modern Movement set out its planning doctrine.

Step 1 – recall the 1933 meeting: The fourth CIAM congress of 1933 studied a large number of cities and framed the idea of the "Functional City".

Step 2 – name its document: Its conclusions, later edited and published by Le Corbusier, are known as the **Athens Charter**, which grouped urban life into the four functions of dwelling, work, recreation and circulation.

Why the other options are wrong:

- The Bauhaus Manifesto (1919, Gropius) was the founding statement of an

art-and-craft school, not an urban charter.
- The Charter of Machu Picchu (1977) was a later reaction *against* the rigid zoning of the Athens Charter.
- The "Garden City Manifesto" is not the CIAM document; the garden city idea came from Ebenezer Howard.

Final Answer: Athens Charter $\Rightarrow$ C

Answer: (C) Go Back to Q2

Q3.

Solution

Concept – reading an architectural style from a building's expression: The style is judged from the facade treatment, roof form and use of ornament.

Step 1 – list the features shown: A repetitive rectilinear grid of glass and steel, an expressed structural frame, a flat roof and a complete absence of applied ornament.

Step 2 – name the style: These are the defining traits of the **International Style**, the machine-age idiom of the 1920s–1950s associated with Gropius, Mies and Le Corbusier and named by Hitchcock and Johnson in 1932.

Why the other options are wrong:

- Art Nouveau uses flowing, plant-like ornament, the opposite of this plain grid.
- Gothic Revival uses pointed arches, tracery and steep roofs.
- Baroque is heavily modelled and ornamented, again unlike the clean glass box.

Final Answer: International Style $\Rightarrow$ C

Answer: (C) Go Back to Q3

Q4.

Solution

Concept – matching famous aphorisms to their authors: Several one-line slogans capture the beliefs of individual modern architects.

Step 1 – recall Mies van der Rohe's motto: Mies is famously linked with **"Less is more"**, expressing his stripped, essential aesthetic.

Step 2 – separate the others: "Form follows function" is Louis Sullivan; "Ornament is crime" echoes Adolf Loos's essay; "Less is a bore" is Robert Venturi's post-modern rejoinder *to* Mies.

Why the other options are wrong:

- "Form follows function" belongs to Sullivan, not Mies.
- "Ornament is crime" is associated with Loos.
- "Less is a bore" is Venturi's deliberate reversal of Mies's slogan.

Final Answer: "Less is more" ⇒ A

Answer: (A) Go Back to Q4

Q5.

Solution

Concept – the origin of "Form follows function": This is one of the founding slogans of modern functional design.

Step 1 – trace the phrase: It was coined by the American architect **Louis Sullivan** (of the Chicago School), in his 1896 essay on the tall office building.

Step 2 – note the lineage: Sullivan was the mentor of Frank Lloyd Wright, who later carried the idea forward into "organic architecture".

Why the other options are wrong:

- Frank Lloyd Wright was Sullivan's pupil and extended the idea but did not originate the phrase.
- Philip Johnson was a much later figure, co-author of the International Style exhibition.
- Daniel Burnham ("make no little plans") was a City Beautiful planner, not the author of this dictum.

Final Answer: Louis Sullivan ⇒ B

Answer: (B) Go Back to Q5

Q6.

Solution

Concept – Bauhaus tubular-steel furniture: The Bauhaus applied the new industrial material, bent steel tube, to everyday furniture.

Step 1 – recall the designer: The cantilevered "Wassily" (Model B3) chair, using a continuous frame of chromed steel tube, was designed by **Marcel Breuer** while he headed the Bauhaus cabinet-making workshop.

Step 2 – explain the cantilever: Because the steel tube is springy, the seat can be carried on a frame with no back legs; the tube flexes slightly to give comfort.

Why the other options are wrong:

- Le Corbusier (with Perriand and Jeanneret) designed other tubular chairs (the LC series) but not the Wassily.
- Charles Eames is known for moulded plywood and fibreglass chairs of the 1940s–50s.
- Eero Saarinen designed the pedestal "Tulip" chair, a different piece.

Final Answer: Marcel Breuer $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q6

Q7.

Solution

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

Step 1 – read the arrangement: Identical elements are repeated one after another at equal intervals, like a colonnade or a run of equal windows.

Step 2 – name the principle: The regular, recurring repetition of like elements is **rhythm**.

Why the other options are wrong:

- Symmetry is a mirror-image balance about a central axis, not mere repetition.
- Hierarchy is the deliberate emphasis of one element over the rest by size, shape or position.
- A datum is a continuous line, plane or volume that ties other elements together; it is not the repetition itself.

Final Answer: Rhythm $\Rightarrow$ A

Answer: (A) Go Back to Q7

Q8.

Solution

Concept – Vitruvius and the qualities of good architecture: The Roman author Vitruvius, in *De architectura*, set out three essential qualities.

Step 1 – translate each Latin term: *Firmitas* means firmness or structural strength; *utilitas* means usefulness or commodity; *venustas* means delight or beauty.

Step 2 – assemble the triad: Together they are commonly rendered as "firmness, commodity and delight".

Why the other options are wrong:

- "Light, air and space" is a modern slogan of hygienic planning, not the Vitruvian triad.
- "Proportion, symmetry, rhythm" are compositional devices, not the three Vitruvian qualities.
- "Cost, time, quality" is the project-management triangle, unrelated to Vitruvius.

Final Answer: firmness, commodity and delight $\Rightarrow$ A

Answer: (A) Go Back to Q8

Q9.

Solution

Concept – what a curtain wall is: Modern facades separate the job of enclosing the building from the job of carrying loads.

Step 1 – state the defining property: A **curtain wall** is a thin, non-load-bearing outer skin that hangs on the edge of the building's structural frame.

Step 2 – list the loads it carries: It supports only its own self-weight and the wind pressure or suction acting on it, and it transfers these back to the floor slabs or columns at each level. It carries no floor or roof load.

Why the other options are wrong:

- A load-bearing masonry wall does carry the floors above; that is the opposite of a curtain wall.
- An internal partition divides interior space and is not the external envelope.
- A retaining wall resists earth pressure, a completely different function.

Final Answer: a non-load-bearing external cladding hung from the frame $\Rightarrow$ D

Answer: (D) Go Back to Q9

Q10.

Solution

Concept – naming the parts of a stick curtain-wall frame: A stick system is assembled on site from vertical and horizontal members.

Step 1 – identify the vertical members: The main vertical members that run floor to floor and carry the wind load back to the slabs are the *mullions*.

Step 2 – identify the horizontal members: The horizontal members that span between the mullions to frame the head and sill of each glass panel are the **transoms**.

Why the other options are wrong:

- Mullions are the vertical members, not the horizontal ones asked for.
- Purlins are roof members that support sheeting, not curtain-wall members.
- A spandrel is the opaque panel that hides the slab edge, not a framing member.

Final Answer: transoms $\Rightarrow$ D

Answer: (D) Go Back to Q10

Q11.

Solution

Concept – reading a rolled steel section by its shape: Steel sections are named for the letter their cross-section resembles.

Step 1 – read the figure: Two wide horizontal flanges are joined by a thin vertical web, giving the outline of the letter I.

Step 2 – name and justify it: This is an **I-section**, rolled in India as the ISMB (Indian Standard Medium-weight Beam). Placing most of the steel in the flanges, far from the neutral axis, maximises the moment of inertia I and hence the bending

resistance for a given weight.

Why the other options are wrong:

- An angle section is L-shaped and is used mainly for bracing and connections.
- A channel is U-shaped (flanges on one side of the web only).
- A flat plate has no flanges and a very low moment of inertia in bending.

Final Answer: I-section (ISMB) $\Rightarrow$ C

Answer: (C) Go Back to Q11

Q12.

Solution

Concept – the PERT expected-time formula: PERT treats each activity duration as a random variable following a beta distribution.

Step 1 – write the weighted mean: The expected (mean) time weights the most likely value four times as heavily as the two extremes: $t_e = \dfrac{t_o + 4\,t_m + t_p}{6}$

Step 2 – interpret the weights: The optimistic and pessimistic estimates each get a weight of 1 and the most likely gets a weight of 4, so the six weights sum to 6 in the denominator.

Step 3 – quick check: If $t_o = t_m = t_p = t$, then $t_e = \dfrac{t + 4t + t}{6} = t$, as it must.

Why the other options are wrong:

- $(t_o + t_m + t_p)/3$ is a plain average that ignores the higher weight on t_m.
- $(t_o + t_p)/2$ drops the most likely time entirely.
- $(t_o + 2t_m + t_p)/4$ uses the wrong weights and denominator.

Final Answer: $t_e = (t_o + 4t_m + t_p)/6 \Rightarrow$ B

Answer: (B) Go Back to Q12

Q13.

Solution

Concept – the float glass process: Modern flat glass owes its flatness to being formed on a liquid metal surface.

Step 1 – recall the bath metal: In Pilkington's float process the molten glass ribbon is floated on a bath of molten **tin**.

Step 2 – explain the choice of tin: Tin is used because it is molten over the working temperature range, is much denser than glass so the glass floats on it, and does not react with or wet the glass; the top surface is levelled by gravity and the bottom by the flat liquid, giving parallel, fire-polished faces.

Why the other options are wrong:

- Lead is far denser and its vapour is highly toxic; it is not used.
- Zinc melts and behaves unsuitably in this range and would react with the glass.
- Mercury is liquid but volatile and extremely toxic, and unsuitable at glass-forming temperatures.

Final Answer: tin $\Rightarrow$ A

Answer: (A) Go Back to Q13

Q14.

Solution

Concept – the parts of a curtain-wall elevation: A curtain wall alternates transparent and opaque horizontal bands up the facade.

Step 1 – read the section: Between the top of the lower window and the sill of the upper window there is an opaque, insulated band that runs in front of the floor slab.

Step 2 – name it: This opaque infill panel is the **spandrel panel**. It hides the slab edge and the services zone and usually carries insulation behind an opaque (often back-painted) glass or metal face.

Why the other options are wrong:

- A transom panel is not the standard term; a transom is a horizontal framing member.
- Vision glass is the transparent window through which one sees out, not the opaque band.
- A mullion cap is a small cover over a mullion, not the slab-height panel.

Final Answer: spandrel panel $\Rightarrow$ C

Answer: (C) Go Back to Q14

Q15.

Solution

Concept – graphical tools of construction management: Progress and scheduling are shown by standard chart types.

Step 1 – describe the chart: A chart in which every activity is a horizontal bar whose left end marks its start, whose length shows its duration, and whose right end marks its finish, all plotted against a common time axis.

Step 2 – name it: This is the **Gantt (bar) chart**, introduced by Henry Gantt and still the commonest way to display a construction programme.

Why the other options are wrong:

- A mass-haul diagram plots cumulative earthwork volume against chainage in road design.
- A histogram shows the frequency distribution of a variable, for example resource usage per week.
- A pie chart shows proportions of a whole, not activities against time.

Final Answer: Gantt (bar) chart $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q15

Q16.

Solution

Concept – maximum bending moment in a simply supported beam under a UDL: For a uniformly loaded simple beam the moment is greatest at midspan.

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

Step 2 – substitute the data: $w = 12$ kN/m and $L = 8$ m.

Step 3 – compute L^2: $L^2 = 8^2 = 64$ m^2.

Step 4 – form the numerator: $wL^2 = 12 \times 64 = 768$ kN $\cdot$ m.

Step 5 – divide by 8: $M_{\max} = \dfrac{768}{8} = 96$ kN $\cdot$ m.

Why the other options are wrong:

- 48 would result from wrongly using $wL^2/16$.
- 120 and 12 do not follow from the correct $wL^2/8$.

Final Answer: 96 kN $\cdot$ m $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q16

Q17.

Solution

Concept – partial safety factor for loads in limit-state design: IS 456 factors up the characteristic loads to guard against overload.

Step 1 – recall the load factor: For the ultimate limit state of collapse under the combination of dead load plus imposed load, the partial safety factor on the loads is **1.5**.

Step 2 – write the design combination: Design load $= 1.5\,(\text{DL} + \text{LL})$.

Why the other options are wrong:

- 1.0 is the factor used at the serviceability limit state (deflection, cracking), not at collapse.
- 1.15 is the partial safety factor applied to the *steel* material, not to the loads.
- 1.25 appears in some special DL+LL+WL combinations but not for the basic DL+LL collapse case.

Final Answer: $1.5 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q17

Q18.

Solution

Concept – placing tension steel in an RCC beam: Reinforcement is placed where the concrete would otherwise crack in tension.

Step 1 – locate the tension zone: Under sagging (positive) bending the beam curves so that the top fibres shorten (compression) and the bottom fibres stretch (tension).

Step 2 – place the steel: Because concrete is weak in tension, the main tension bars are placed near the **bottom** face, in the tension zone, to carry the tensile force.

Step 3 – note the top bars: The small bars near the top are hanger bars that hold the stirrups in position; they are not the main tension steel.

Why the other options are wrong:

- Steel at the top face would sit in the compression zone, where concrete is

already strong.
- Steel exactly at the neutral axis carries almost no flexural stress.
- Spreading it uniformly around the perimeter wastes steel in the compression zone.

Final Answer: near the bottom (tension) face $\Rightarrow$ A

Answer: (A) Go Back to Q18

Q19.

Solution

Concept – the meaning of a concrete grade designation: The number in an M-grade is the characteristic cube strength.

Step 1 – decode "M25": The letter M stands for mix and the number is the characteristic compressive strength f_{ck} in N/mm^2 of a 150 mm cube at 28 days.

Step 2 – state the value: Hence for M25, $f_{ck} =$ **25 N/mm^2**.

Step 3 – meaning of "characteristic": It is the strength below which not more than 5% of the test cubes are expected to fall.

Why the other options are wrong:

- 15 N/mm^2 corresponds to M15, not M25.
- 30 N/mm^2 corresponds to M30.
- 20 N/mm^2 corresponds to M20.

Final Answer: 25 N/mm^2 $\Rightarrow$ A

Answer: (A) Go Back to Q19

Q20.

Solution

Concept – modulus of elasticity of concrete: IS 456 relates the elastic modulus to the square root of the cube strength.

Step 1 – write the code formula: $E_c = 5000\sqrt{f_{ck}}$ N/mm^2.

Step 2 – substitute f_{ck} for M25: $f_{ck} = 25$ N/mm^2.

Step 3 – take the square root: $\sqrt{25} = 5$.

Step 4 – multiply: $E_c = 5000 \times 5 = 25000$ N/mm^2 (that is, 25 GPa).

Why the other options are wrong:

- 5000 ignores the $\sqrt{f_{ck}}$ factor.
- 12500 would need $\sqrt{f_{ck}} = 2.5$, wrong for M25.
- 50000 doubles the correct value.

Final Answer: 25000 N/mm^2 $\Rightarrow$ D

Answer: (D) Go Back to Q20

Q21.

Solution

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

Step 1 – write the standard result: $M_{\text{fixed}} = \dfrac{wL^2}{2}$, where w is the load per metre and L is the cantilever length.

Step 2 – substitute the data: $w = 8$ kN/m and $L = 3$ m.

Step 3 – compute L^2: $L^2 = 3^2 = 9$ m^2.

Step 4 – form the numerator: $wL^2 = 8 \times 9 = 72$ kN $\cdot$ m.

Step 5 – divide by 2: $M_{\text{fixed}} = \dfrac{72}{2} = 36$ kN $\cdot$ m.

Why the other options are wrong:

- 18 would come from wrongly using $wL^2/4$.
- 12 has no correct derivation here.
- 72 is wL^2 before dividing by 2.

Final Answer: 36 kN $\cdot$ m $\Rightarrow$ A

Answer: (A) Go Back to Q21

Q22.

Solution

Concept – definition of the daylight factor: Daylight is judged not in absolute lux but relative to the sky brightness at the same instant.

Step 1 – write the definition: DF $= \dfrac{E_{\text{indoor}}}{E_{\text{outdoor}}} \times 100\%$, where E_{indoor} is the illuminance at the interior point and E_{outdoor} is the illuminance on an unobstructed horizontal plane under the same overcast sky.

Step 2 – why an overcast sky is specified: An overcast sky is used as the reference because its brightness distribution is stable and does not depend on the sun's position, so the ratio stays constant even as the outdoor level changes.

Why the other options are wrong:

- It is not the ratio of direct sunlight to skylight.
- It is not a ratio of vertical to horizontal illuminance.
- Window-to-floor area is a crude rule of thumb, not the definition of daylight factor.

Final Answer: indoor to simultaneous outdoor illuminance, as a percentage $\Rightarrow$ C

Answer: (C) Go Back to Q22

Q23.

Solution

Concept – computing a daylight factor: Apply the definition directly to the measured values.

Step 1 – write the formula: $\text{DF} = \dfrac{E_{\text{indoor}}}{E_{\text{outdoor}}} \times 100\%$.

Step 2 – substitute the data: $E_{\text{indoor}} = 250$ lux and $E_{\text{outdoor}} = 10000$ lux.

Step 3 – form the ratio: $\dfrac{250}{10000} = 0.025$.

Step 4 – convert to a percentage: $0.025 \times 100 = 2.5\%$.

Why the other options are wrong:

- 25% misplaces the decimal by a factor of ten.
- 0.25% divides by an extra factor of ten.
- 40% is the inverse ratio ($10000/250$ scaled), which is meaningless here.

Final Answer: $2.5\% \Rightarrow$ B

Answer: (B) Go Back to Q23

Q24.

Solution

Concept – the three components of daylight factor: Daylight reaching an interior point arrives by three distinct paths.

Step 1 – name the first two: The *sky component* is light coming straight from a patch of sky visible through the window; the *externally reflected component* is light that first bounces off outside surfaces (opposite buildings, ground) before entering.

Step 2 – name the third: The remaining path is light that enters and then reflects off the room's own interior surfaces (walls, ceiling, floor) before reaching the point. This is the **internally reflected component**.

Step 3 – add them: DF $=$ SC $+$ ERC $+$ IRC.

Why the other options are wrong:

- Direct sunlight is deliberately excluded; daylight factor is defined under a sunless overcast sky.
- "Glare component" is not a component of daylight factor.
- Artificial light is not daylight and is not part of the daylight factor.

Final Answer: internally reflected component $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q24

Q25.

Solution

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

Step 1 – write the defining equation: $Q = U\,A\,\Delta T$, where Q is heat flow in watts, A is area in m^2 and ΔT is the temperature difference in kelvin.

Step 2 – rearrange for U: $U = \dfrac{Q}{A\,\Delta T}$.

Step 3 – substitute the units: $U = \dfrac{\text{W}}{\text{m}^2 \cdot \text{K}}$, that is $\text{W}/(\text{m}^2 \cdot \text{K})$.

Why the other options are wrong:

- W/m^2 omits the temperature difference and is a heat-flux unit.
- W·m/K is the unit of thermal conductivity k, not of U.
- W/K omits the area.

Final Answer: $\mathrm{W/(m^2 \cdot K)} \Rightarrow \boxed{\mathrm{C}}$

Answer: (C) Go Back to Q25

Q26.

Solution

Concept – why factory roofs use north light: Good workshop lighting needs brightness without glare or solar heat gain.

Step 1 – read the geometry: The saw-tooth roof has steep glazed faces turned toward the north and opaque sloping faces toward the south.

Step 2 – explain the orientation: In the northern hemisphere the sun never shines directly on a true-north face, so the north glazing admits only **steady, diffuse north-sky daylight**. This gives even illumination for machines and drawing work while keeping out direct sun, glare and the heat that would come with south light.

Why the other options are wrong:

- It is designed to *exclude* direct sun, not admit maximum summer sun.
- Rainwater collection is not the purpose of the north orientation.
- The saw-tooth form does not reduce the structural span; that is set by the trusses.

Final Answer: admit steady, glare-free diffuse north light $\Rightarrow \boxed{\mathrm{D}}$

Answer: (D) Go Back to Q26

Q27.

Solution

Concept – the unit of sound level: Loudness is measured on a logarithmic scale relative to a reference.

Step 1 – state the unit: The sound (pressure or intensity) level is expressed in **decibels (dB)**.

Step 2 – explain the logarithm: Because the ear responds over an enormous range of intensities, the level is defined as $L = 10\log_{10}(I/I_0)$, with I_0 the reference intensity; each 10 dB step is a tenfold change in intensity.

Why the other options are wrong:

- The lux is the unit of illuminance (lighting), not sound.
- The lumen is the unit of luminous flux.
- The candela is the unit of luminous intensity.

Final Answer: decibel (dB) $\Rightarrow$ C

Answer: (C) Go Back to Q27

Q28.

Solution

Concept – earth-leakage protection for people: Different protective devices guard against different faults.

Step 1 – describe the device: An **earth-leakage circuit breaker (ELCB), now the residual-current circuit breaker (RCCB)**, continuously compares the current flowing out in the live conductor with the current returning in the neutral.

Step 2 – explain the trip: If some current is leaking to earth (for example through a person touching a faulty appliance), the two currents no longer balance; the residual difference trips the breaker within milliseconds, protecting against fatal shock.

Why the other options are wrong:

- A plain MCB trips on overcurrent and short circuit to protect the wiring, not on small earth leakage.
- An isolator is a manual on/off switch with no automatic sensing.
- A capacitor bank corrects power factor and has no protective role.

Final Answer: ELCB / RCCB $\Rightarrow$ A

Answer: (A) Go Back to Q28

Q29.

Solution

Concept – Kevin Lynch's "imageability": Lynch studied how clearly people can picture and navigate a city.

Step 1 – define the term: Imageability (also called legibility) is the quality of a physical environment that makes it easy for an observer to identify its parts and organise them into a clear, coherent mental image or "map".

Step 2 – link to his five elements: A highly imageable city has strong paths,

edges, districts, nodes and landmarks, so people can orient themselves and find their way.

Why the other options are wrong:

- Land value is an economic measure, not Lynch's perceptual quality.
- Road-network density is a purely quantitative measure of connectivity.
- Total built-up floor area is a bulk figure unrelated to mental image.

Final Answer: the ease of forming a clear mental image of the city $\Rightarrow$ B

Answer: (B) Go Back to Q29

Q30.

Solution

Concept – the ha-ha in landscape design: Eighteenth-century English gardens used a hidden barrier to keep an open view.

Step 1 – read the section: The garden lawn ends at a vertical retaining wall that drops into a ditch, and the ground beyond rises back to the parkland.

Step 2 – name and explain it: This device is a **ha-ha**. The wall and ditch stop grazing animals from entering the garden, yet because the barrier is sunk below the line of sight it is invisible from the house, giving an unbroken view over the landscape.

Why the other options are wrong:

- A pergola is an overhead beamed structure for climbing plants.
- A parterre is a formal, patterned planting bed on level ground.
- Topiary is the art of clipping shrubs into shapes.

Final Answer: ha-ha $\Rightarrow$ A

Answer: (A) Go Back to Q30

Q31.

Solution

Concept – linear green open space: Green networks link parks with continuous corridors.

Step 1 – describe the feature: A long, narrow strip of planted open space, often laid along a river or an abandoned rail line, that joins parks and carries a walking

and cycling route.

Step 2 – name it: This is a **greenway**, valued for recreation, non-motorised movement and ecological connectivity.

Why the other options are wrong:

- A cul-de-sac is a dead-end street, not an open-space corridor.
- A plaza is a compact hard-paved square, not a linear route.
- An atrium is an internal top-lit court inside a building.

Final Answer: greenway $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q31

Q32.

Solution

Concept – the enclosed civic square: Camillo Sitte praised the traditional European open space bounded by buildings.

Step 1 – read the description: A hard-paved public open space at the centre of a town, enclosed on its sides by continuous building frontages that give it a room-like sense of enclosure.

Step 2 – name it: This is the **piazza**, or town square, the type Sitte analysed in *City Planning According to Artistic Principles*.

Why the other options are wrong:

- A boulevard is a wide tree-lined avenue, a linear element.
- A greenbelt is a ring of open country around a town, not a paved square.
- A cul-de-sac is a residential dead-end street.

Final Answer: piazza (town square) $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q32

Q33.

Solution

Concept – the enclosure ratio of an urban square: The felt sense of enclosure depends on the height of the walls relative to the width.

Step 1 – state the design guideline: Studies of pleasant squares suggest a height-

to-width ratio $H : D$ of roughly **1:3 to 1:4**; that is, the width of the square is about three to four times the height of the surrounding buildings.

Step 2 – explain the limits: If the width grows much beyond four times the height the space feels exposed and loses enclosure; if the height approaches the width the space begins to feel cramped, like a shaft.

Why the other options are wrong:

- $1 : 10$ gives a vast, weakly enclosed space.
- $3 : 1$ would make the buildings three times taller than the square is wide, an oppressive canyon.
- $1 : 20$ is effectively an open field with no enclosure.

Final Answer: $1 : 3$ to $1 : 4 \Rightarrow$ B

Answer: (B) Go Back to Q33

Q34.

Solution

Concept – FAR, footprint and number of floors: FAR fixes the total floor area; the footprint fixes how much of that goes on each floor.

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

Step 2 – note the floor footprint: Setbacks limit each floor to a footprint of 320 m^2.

Step 3 – divide to get the number of floors: Floors $= \dfrac{1600}{320} = 5$.

Step 4 – interpret: Five equal floors of 320 m^2 each exactly use up the permitted 1600 m^2.

Why the other options are wrong:

- 2 or 4 floors leave a large part of the permitted FAR unused.
- 8 floors would need $8 \times 320 = 2560$ m^2, well above the 1600 m^2 allowed.

Final Answer: 5 floors $\Rightarrow$ B

Answer: (B) Go Back to Q34

Q35.

Solution

Concept – what fixes the size of a Neighbourhood Unit: Perry sized the unit around a daily community facility used by all families.

Step 1 – identify the governing facility: The neighbourhood is built around **one elementary school** placed at its centre.

Step 2 – derive the size: The population is set at the number of families needed to fill that one school (Perry took roughly 5000–6000 people), and the area is that which keeps every home within an easy walking radius of about 400 m (a quarter mile) of the school.

Why the other options are wrong:

- Building height does not govern the unit's population or extent.
- The unit centres on a primary school, not a district hospital, which serves a much larger catchment.
- The length of a water main is an engineering detail, not the sizing principle.

Final Answer: population to support one elementary school within about 400 m $\Rightarrow$ C

Answer: (C) Go Back to Q35

Q36.

Solution

Concept – Perry's traffic principle for the Neighbourhood Unit: Perry wanted children to reach the central school without crossing heavy traffic.

Step 1 – read the plan: Fast arterial roads form the four boundaries of the unit, while the internal streets are narrow and often curved or cul-de-sac.

Step 2 – state the principle: Arterial through-traffic streets are placed on the **periphery** of the unit, defining its edges, and the internal street system is deliberately made unattractive to through-traffic so it serves local access only.

Step 3 – explain the benefit: This keeps fast traffic out of the residential interior, so the school and open spaces at the centre are reached safely on foot.

Why the other options are wrong:

- Running the arterial through the centre would cut the unit in two and endanger schoolchildren.

- A diagonal arterial would slice the interior and invite through-traffic.
- Putting roads underground is not part of Perry's scheme.

Final Answer: on the periphery of the unit $\Rightarrow$ B

Answer: (B) Go Back to Q36

Q37.

Solution

Concept – the innovation of the Radburn layout: Radburn responded to the arrival of the motor car in residential design.

Step 1 – recall the scheme: Stein and Wright planned Radburn around large *superblocks*: houses were grouped around short cul-de-sac service lanes, while a continuous system of interior parks and footpaths ran through the blocks.

Step 2 – state the key idea: Its lasting contribution is the **complete separation of pedestrian and vehicular traffic**, with footpaths crossing roads by underpasses or bridges so that people and cars never conflict.

Why the other options are wrong:

- Radburn used low-rise houses, not high-rise towers.
- The linear ribbon city is a different concept (Soria y Mata).
- Radburn rejected the gridiron in favour of the superblock and cul-de-sac.

Final Answer: the superblock with pedestrian–vehicular separation $\Rightarrow$ B

Answer: (B) Go Back to Q37

Q38.

Solution

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

Step 1 – write the formula: Density $= \dfrac{\text{population}}{\text{area}}$.

Step 2 – substitute the data: Population $= 3600$ persons; net residential area $= 12$ ha.

Step 3 – divide: Density $= \dfrac{3600}{12} = 300$ persons/ha.

Why the other options are wrong:

- 100 persons/ha would need an area of 36 ha for 3600 persons.
- 200 persons/ha would need 18 ha.
- 360 persons/ha would need only 10 ha, not the 12 ha given.

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

Answer: (D) Go Back to Q38

Q39.

Solution

Concept – carpet area versus built-up and plinth area: The three area terms differ by what walls and extras they include.

Step 1 – define carpet area: The **carpet area** is the net usable floor area inside a dwelling, the area over which a carpet could actually be laid, measured within the inner faces of the walls and *excluding* the wall thickness.

Step 2 – contrast the others: The built-up (plinth) area adds the thickness of the walls and any balconies; the super built-up area further adds a share of common corridors and lobbies.

Why the other options are wrong:

- Measuring to the outer face of external walls gives the plinth (built-up) area, not carpet area.
- Including balconies, walls and common areas gives the super built-up area.
- The plot area is the land parcel, unrelated to internal floor area.

Final Answer: net usable floor area within the walls $\Rightarrow$ B

Answer: (B) Go Back to Q39

Q40.

Solution

Concept – the buffer operation in GIS: GIS proximity analysis draws zones of influence around features.

Step 1 – describe the operation: A **buffer** creates a new polygon that encloses all locations within a stated distance of a chosen feature; around the lake it is the band of land lying within 100 m of the shoreline.

Step 2 – note its use: Buffers are used for tasks such as pollution set-backs, noise zones along roads, or catchment areas around facilities.

Why the other options are wrong:

- Overlay combines two or more existing layers; it does not create a distance zone.
- Geocoding converts an address into map coordinates.
- Interpolation estimates values at unsampled points from known ones.

Final Answer: buffer $\Rightarrow$ D

Answer: (D) Go Back to Q40

Q41.

Solution

Concept – overlay analysis in GIS: Suitability mapping combines many criteria held in separate layers.

Step 1 – describe the operation: In **overlay analysis** two or more thematic layers are stacked and combined cell-by-cell (or polygon-by-polygon) so that a new layer records where the required conditions all coincide.

Step 2 – give the example: Superimposing slope, land use, soil and distance-from-road layers and keeping only the areas that pass every test yields the land most suitable for the intended use.

Why the other options are wrong:

- Buffering makes a distance zone around one feature; it does not merge several criteria layers.
- Digitising is the act of tracing features into vector form.
- Rubber-sheeting geometrically warps a layer to fit control points.

Final Answer: overlay analysis $\Rightarrow$ A

Answer: (A) Go Back to Q41

Q42.

Solution

Concept – how an EDM measures distance: Electronic distance measurement replaces the chain with a wave-timing method.

Step 1 – describe the principle: The instrument sends a modulated electromagnetic wave (usually infrared light, sometimes microwave) to a reflecting prism at

the far point, which returns it to the instrument.

Step 2 – extract the distance: From the measured travel time, or more precisely the phase shift of the returned wave, and the known speed of the wave, the instrument computes the slope distance and displays it. Because it uses the constant speed of light, it is fast and accurate over long lines.

Why the other options are wrong:

- Pacing is a rough, non-electronic method.
- A metallic chain is the traditional manual tool the EDM replaces.
- Reading a levelling staff measures height difference, not horizontal distance.

Final Answer: timing/phase shift of a reflected electromagnetic wave $\Rightarrow$ C

Answer: (C) Go Back to Q42

Q43.

Solution

Concept – what a total station is: The total station merged the two classic survey measurements into one instrument.

Step 1 – name its parts: A total station combines an **electronic theodolite** (which measures horizontal and vertical angles) with an **EDM** (which measures distances) and an on-board microprocessor and data logger.

Step 2 – describe its output: From the angle and distance to a prism it computes and stores the horizontal distance, height difference and the three-dimensional coordinates of each point, so a whole survey can be recorded digitally in the field.

Why the other options are wrong:

- A level and chain measure heights and distances only, with no angle capability and no processor.
- A plane table and alidade is a graphical mapping method, not an electronic instrument.
- A GPS receiver with a barometer is satellite positioning, a different technology from a total station.

Final Answer: an electronic theodolite plus an EDM with a data logger $\Rightarrow$ C

Answer: (C) Go Back to Q43

Q44.

Solution

Concept – camber of a road: The pavement is shaped in cross-section so that water does not stand on it.

Step 1 – read the section: The carriageway is highest at its centre-line (the crown) and slopes gently down towards both edges.

Step 2 – name and explain it: This transverse (cross) slope is the **camber** or cross-fall. It drains rainwater quickly off the surface into the side drains, preventing ponding, skidding and damage to the pavement.

Why the other options are wrong:

- Superelevation is the transverse slope on a curve to counter centrifugal force, not the straight-road drainage slope.
- A longitudinal gradient is the slope along the length of the road, not across it.
- Right-of-way is the total width of land reserved for the road, not a slope.

Final Answer: camber (cross-fall) $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q44

Q45.

Solution

Concept – superelevation on a horizontal curve: A vehicle on a curve needs help to resist the outward centrifugal force.

Step 1 – describe the geometry: On a horizontal curve the outer edge of the carriageway is raised above the inner edge, tilting the whole road surface inwards towards the centre of the curve.

Step 2 – name and justify it: This raising is called **superelevation**. By tilting the surface, part of the vehicle's weight provides the centripetal force, so the resultant of weight and centrifugal force stays nearly perpendicular to the road and the tendency to skid or overturn is reduced.

Why the other options are wrong:

- Camber is the drainage cross-slope on a straight road, not the curve tilt.
- Stopping sight distance is a length along the road, not a cross-slope.
- Kerb height is the height of the edge kerb, unrelated to the curve tilt.

Final Answer: superelevation $\Rightarrow$ A

Answer: (A) Go Back to Q45

Q46.

Solution

Concept – separate versus combined sewerage: Sewerage systems are classified by how they handle sewage and storm water.

Step 1 – define the separate system: In a **separate system** the foul sanitary sewage is carried in one set of sewers and the storm-water runoff in an entirely different set, so the two flows never mix.

Step 2 – explain the advantage: Only the (relatively small, steady) sewage flow reaches the treatment plant, so the plant is not overloaded during storms; the clean storm water can be discharged directly to a watercourse without treatment.

Why the other options are wrong:

- Carrying both in one pipe is the *combined* system, the opposite of separate.
- Using only open surface drains describes neither a proper sewage nor storm system.
- Sending both through the same pipe at different times is not a recognised system; the two flows are separated by pipe, not by timing.

Final Answer: two entirely independent pipe networks $\Rightarrow$ A

Answer: (A) Go Back to Q46

Answer Key

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