# GATE Architecture and Planning

## Sample Paper – 4

**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 curvilinear tower (shikhara) that rises over the sanctum of a North Indian temple, as seen at the Kandariya Mahadeva temple, Khajuraho, is the defining feature of which temple style? **[1 mark]**

(A) Dravidian style

(B) Vesara style

(C) Nagara style

(D) Indo-Saracenic style

**Q2.** The towering, ornately sculpted gateway pyramid built over the entrance to a South Indian (Dravidian) temple complex is called the: **[1 mark]**

(A) Shikhara

(B) Gopuram

(C) Amalaka

(D) Torana

**Q3.** The "Open Hand" monument, the emblem chosen for the new capital city of Chandigarh, was conceived by the architect who master-planned that city: **[1 mark]**

(A) Le Corbusier

(B) Louis Kahn

(C) Edwin Lutyens

(D) Otto Koenigsberger

**Q4.** The Indian Institute of Management (IIM) at Ahmedabad, celebrated for its monumental exposed-brick geometry and dramatic arched openings, was designed by: **[1 mark]**

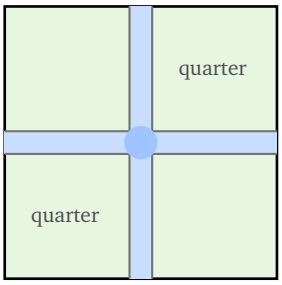
(A) B. V. Doshi

(B) Charles Correa

(C) Louis Kahn

(D) Le Corbusier

**Q5.** The formal Mughal garden shown, divided into four equal quarters by a pair of axial water channels and walkways, as at the Taj Mahal and the Shalimar Bagh, is known as the: **[1 mark]**




water channels

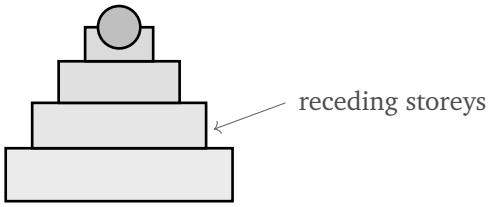
(A) Char-bagh

(B) Baradari

(C) Diwan-i-Khas

(D) Char-minar

**Q6.** In Dravidian temple architecture, the pyramidal tower built up in a series of receding storeys directly over the sanctum (garbhagriha), as sketched, is called the: **[1 mark]**




(A) Shikhara

(B) Vimana

(C) Mandapa

(D) Gopuram

**Q7.** The architect of the Vidhan Bhavan (State Assembly) at Bhopal and the leading proponent of "open-to-sky space" as a climatic and cultural device in tropical India, was: **[1 mark]**

(A) Charles Correa

(B) Raj Rewal

(C) Achyut Kanvinde

(D) Joseph Allen Stein

**Q8.** An ordering principle of composition in which a continuous line, plane or space is used to collect, gather and organise an otherwise random pattern of forms into a coherent whole is called a: **[1 mark]**

(A) Datum

(B) Hierarchy

(C) Rhythm

(D) Symmetry

## Building Construction, Materials and Management

**Q9.** As per IS 456:2000, the grade designation "M25" for concrete denotes a characteristic (5-percentile) compressive strength, measured on standard cubes, of: [1 mark]

(A) $25$ N/mm$^2$ at 7 days

(B) $25$ kN/mm$^2$ at 28 days

(C) a fixed mix ratio of $1 : 2 : 5$

(D) $25$ N/mm$^2$ at 28 days

**Q10.** In concrete mix design, for a given set of materials and full compaction, the compressive strength of hardened concrete is governed primarily by (Abrams' law): [1 mark]

(A) the cement content alone

(B) the colour of the coarse aggregate

(C) the fineness modulus of the sand only

(D) the water–cement ratio

**Q11.** The nominal mix proportion (cement : fine aggregate : coarse aggregate, by volume) conventionally associated with M20 grade concrete is: [1 mark]

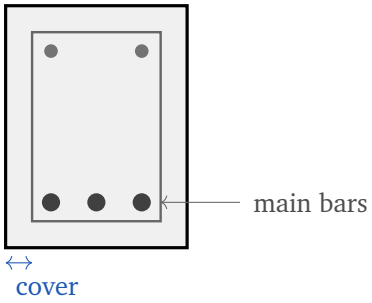
(A) $1 : 1 : 2$

(B) $1 : 3 : 6$

(C) $1 : 1.5 : 3$

(D) $1 : 2 : 4$

**Q12.** In the reinforced-concrete beam cross-section shown, the clear cover is the distance from the concrete surface to the nearest reinforcement. As per IS 456 for a beam under moderate exposure, the nominal clear cover to the main bars is generally: **[1 mark]**



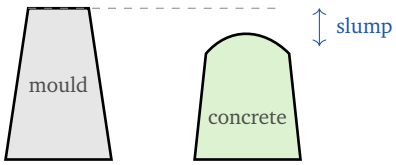

(A) 15 mm

(B) 30 mm

(C) 75 mm

(D) 5 mm

**Q13.** In the slump test shown, the workability of fresh concrete is read from the vertical subsidence of the cone of concrete once the mould is lifted. A measured slump in the range 75–100 mm indicates concrete of: **[1 mark]**




(A) very low workability (essentially zero slump)

(B) an extremely dry, unmixable batch

(C) medium (good) workability suited to normal reinforced concrete

(D) fully segregated, unusable concrete

**Q14.** As per IS 456, the minimum period for which ordinary Portland cement concrete should be kept continuously moist (cured) under normal weather, to allow proper strength gain, is at least: **[1 mark]**

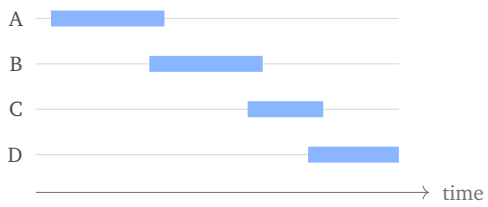
(A) 7 days

(B) 1 day

(C) 90 days

(D) 2 hours

**Q15.** The project-management chart shown, in which each activity is drawn as a horizontal bar against a common time scale with the bar length proportional to the activity's duration, is a: **[1 mark]**




(A) Pie chart

(B) Mass-haul diagram

(C) Histogram

(D) Gantt (bar) chart

## Building Structures and Systems

**Q16.** For a plane (2-D) pin-jointed truss with $m$ members, $j$ joints and $r$ external reaction components, the condition for the truss to be just statically determinate is: **[1 mark]**

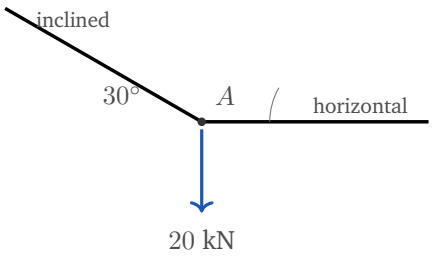
(A) $m + r = 3j - 3$

(B) $m + r = 2j$

(C) $m = 2j + r$

(D) $m + j = 2r$

**Q17.** At joint $A$ of the pin-jointed truss shown, a vertical downward load of $20$ kN is carried by two members: one horizontal and one inclined at $30^\circ$ to the horizontal. By the method of joints, the magnitude of the axial force in the inclined member is: **[1 mark]**




(A) 40 kN

(B) 20 kN

(C) 10 kN

(D) 34.6 kN

**Q18.** A three-dimensional structural system assembled from many short members arranged in a repetitive geometric pattern (often tetrahedra and octahedra), used to roof large column-free spaces such as exhibition halls, is a: **[1 mark]**

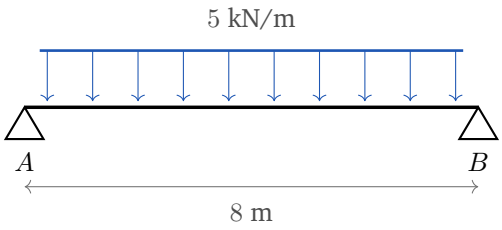
(A) Shear wall

(B) Portal frame

(C) Space frame

(D) Catenary cable

**Q19.** A simply supported beam of span 8 m carries a uniformly distributed load of 5 kN/m over its entire length, as shown. Each end reaction is: **[1 mark]**




(A) 40 kN

(B) 20 kN

(C) 10 kN

(D) 5 kN

**Q20.** The elastic critical (buckling) load of a long, slender, axially loaded column, given by Euler's theory, is inversely proportional to the: [1 mark]

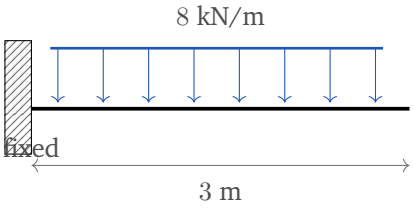
(A) square of the effective length

(B) cross-sectional area only

(C) square root of the length

(D) modulus of elasticity

**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

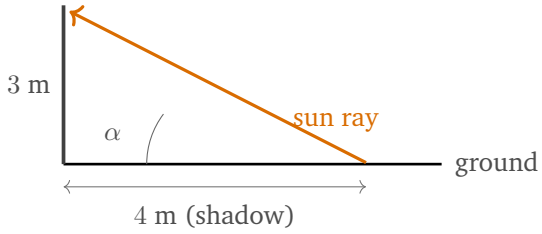
(B) 36 kN·m

(C) 12 kN·m

(D) 72 kN·m

## Environmental Design and Building Services

**Q22.** A vertical pole of height 3 m casts a shadow 4 m long on level ground, as shown. The altitude angle $\alpha$ of the sun above the horizon is nearest to: [2 marks]




(A) 53°

(B) $45^\circ$

(C) $30^\circ$

(D) $37^\circ$

**Q23.** Using Sabine's formula $\mathrm{RT}_{60} = \dfrac{0.161\,V}{A}$, an auditorium of volume $600$ m$^3$ has a total absorption of $60$ metric sabins. Its reverberation time is nearest to: [2 marks]

(A) $0.80$ s

(B) $2.42$ s

(C) $1.61$ s

(D) $3.20$ s

**Q24.** The overall heat-transfer coefficient of a building element, expressing the steady rate of heat flow per unit area per unit temperature difference across it (units W/m$^2$K), is known as its: [2 marks]

(A) U-value (thermal transmittance)

(B) R-value (thermal resistance)

(C) albedo

(D) time lag

**Q25.** The daylight factor at a point inside a room is defined as the ratio, expressed as a percentage, of the illuminance at that point to the: [2 marks]

(A) illuminance from the artificial lighting installed

(B) illuminance measured exactly one year earlier

(C) illuminance from direct beam sunlight only

(D) simultaneous outdoor illuminance from an unobstructed overcast sky

**Q26.** In air-conditioning practice, one "ton of refrigeration" is the rate of heat removal equal to the heat needed to melt one short ton of ice in $24$ hours. In SI units this is approximately: **[2 marks]**

(A) $1.0$ kW

(B) $0.10$ kW

(C) $0.746$ kW

(D) $3.5$ kW

**Q27.** A partition wall's ability to reduce the transmission of airborne sound from one room to the next is quantified by its: **[2 marks]**

(A) Sound Transmission Class (sound reduction index)

(B) reverberation time

(C) absorption coefficient

(D) glare index

**Q28.** In a building's internal drainage, a $100$ mm diameter horizontal soil (waste) pipe is commonly laid at a minimum self-cleansing gradient of about: **[2 marks]**

(A) $1$ in $5$

(B) $1$ in $40$

(C) $1$ in $500$

(D) dead flat (no slope)

## Urban Design and Landscape Architecture

**Q29.** The book *The Death and Life of Great American Cities* (1961), which attacked large-scale modernist urban renewal and championed dense, mixed-use streets with "eyes on the street", was written by: **[2 marks]**

(A) Kevin Lynch

(B) Jane Jacobs

(C) Gordon Cullen

(D) Camillo Sitte

**Q30.** A linear public open-space corridor, often laid along a river bank or a disused railway alignment, that connects parks and neighbourhoods for recreation and non-motorised movement, is called a: [2 marks]

(A) Cul-de-sac

(B) Piazza

(C) Greenway

(D) Roundabout

**Q31.** Transit-oriented development (TOD), an urban-design strategy increasingly adopted along metro corridors in Indian cities, essentially promotes: [2 marks]

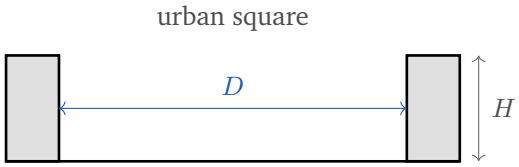
(A) low-density, car-dependent sprawl set far away from stations

(B) single-use heavy-industrial estates on the urban fringe

(C) compact, mixed-use, walkable development within easy walking distance of a mass-transit station

(D) exclusive gated enclaves deliberately cut off from public transit

**Q32.** In the design of an urban square, the sense of enclosure depends on the ratio of the height $H$ of the surrounding buildings to the width $D$ of the open space, as shown. A ratio of about $H : D = 1 : 2$ to $1 : 3$ generally gives: [2 marks]




(A) a comfortable, well-defined sense of enclosure appropriate to a public square

(B) a claustrophobic, canyon-like space

(C) no spatial definition whatsoever

(D) a narrow, tunnel-like corridor

**Q33.** A built-up urban area that is measurably warmer than its surrounding countryside, because heat-absorbing paved surfaces and buildings replace vegetation, is described as an: [2 marks]

(A) urban canyon

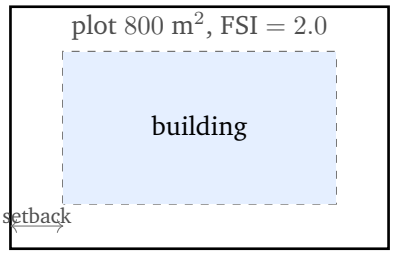
(B) urban village

(C) urban heat island

(D) urban sprawl

## Urban and Regional Planning and Housing

**Q34.** A plot of area $800$ m$^2$ is permitted a Floor Space Index (FSI / FAR) of $2.0$, with the setback envelope shown. The maximum permissible total built-up (floor) area on the plot is: [2 marks]




(A) $400$ m$^2$

(B) $800$ m$^2$

(C) $1200$ m$^2$

(D) $1600$ m$^2$

**Q35.** The statutory plan that lays down the long-term (usually $20$–$25$ year) spatial development framework, land-use zoning and major infrastructure proposals for a city, and serves as the parent document for zonal and layout plans, is the: [2 marks]

(A) Zonal plan

(B) Layout plan

(C) Annual action plan

(D) Master (Development) Plan

**Q36.** A housing programme in which the public agency provides only a serviced plot with basic infrastructure (water, sewerage, road and often a small core unit), leaving the household to complete the dwelling incrementally by self-help, is called a: [2 marks]

(A) ready-built high-rise flats scheme

(B) transit (temporary) housing scheme

(C) site-and-services scheme

(D) rental barracks scheme

**Q37.** The theory that explains the size, number and spacing of settlements as a nested hierarchy of "central places", each serving a surrounding market (complementary) area, was propounded by: [2 marks]

(A) Ebenezer Howard

(B) Patrick Geddes

(C) Clarence Perry

(D) Walter Christaller

**Q38.** A residential neighbourhood houses a population of 12000 persons on a gross site area of 40 hectares. The gross residential density of the neighbourhood is: [2 marks]

(A) 300 persons/ha

(B) 150 persons/ha

(C) 480 persons/ha

(D) 200 persons/ha

**Q39.** In Indian urban housing policy and allotment, the abbreviation "EWS", used to denote the lowest income category eligible for subsidised housing, stands for: [2 marks]

(A) Extra Wide Street

(B) Eastern Water Supply

(C) Economically Weaker Section

(D) Environmental Work Standard

## Planning Techniques, Surveying and GIS

**Q40.** The method of plane-table surveying in which the table is set up in turn at each of two known stations and rays are drawn to a distant object, whose position is fixed at the meeting point of the two rays, is called: [2 marks]

(A) Radiation

(B) Traversing

(C) Resection

(D) Intersection

**Q41.** A "total station", the standard instrument of modern engineering survey, is essentially an electronic theodolite integrated with: [2 marks]

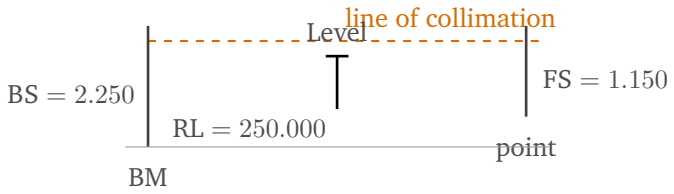
(A) a plane table and alidade

(B) an electronic distance measurement (EDM) unit and an on-board data recorder

(C) a dumpy level only

(D) a magnetic (prismatic) compass only

**Q42.** In differential levelling from a benchmark of reduced level $250.000$ m, a back sight of $2.250$ m is taken on the benchmark and a fore sight of $1.150$ m on a forward point, as shown. The reduced level of the forward point is: [2 marks]




(A) 251.100 m

(B) 248.900 m

(C) 253.400 m

(D) 250.000 m

**Q43.** In plane-table surveying, the operation of determining the location of the plane-table station itself by sighting back to two or more well-defined points of already known position is called: **[2 marks]**

(A) Radiation

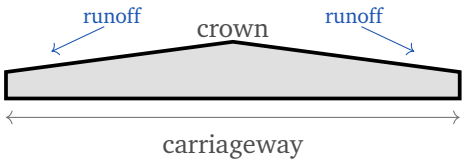
(B) Resection

(C) Intersection

(D) Levelling

## Infrastructure, Services and Transportation Planning

**Q44.** The gentle transverse slope given to a road surface, falling from the crown at the centre to the edges as shown, provided so that rainwater drains quickly off the carriageway, is called the: **[2 marks]**




(A) Superelevation

(B) Camber (cross-fall)

(C) Longitudinal gradient

(D) Right-of-way

**Q45.** In the classical four-stage urban transportation planning process, the stage that divides the estimated trips among the competing travel modes (private car, bus, metro rail, walking) is called: **[2 marks]**

(A) Trip generation

(B) Trip distribution

(C) Traffic assignment

(D) Modal split

**Q46.** In the hydraulic design of a sanitary sewer, the minimum "self-cleansing" velocity of flow, needed to keep suspended solids in motion and prevent silting, is generally taken as about: **[2 marks]**

(A) $0.1$ m/s

(B) $0.6$ m/s

(C) $3.0$ m/s

(D) $10$ m/s

## Detailed Solutions

**Q1.**

**Solution**

**Concept – the two great families of Indian temple architecture:** Hindu temples are broadly classified by the form of the tower that crowns the sanctum.

**Step 1 – describe the North Indian tower:** The **Nagara** (North Indian) style is marked by a *curvilinear* tower, the *shikhara*, which rises in a smooth beehive-like curve and is capped by a ribbed disc (amalaka) and finial.

**Step 2 – match to the example:** The Kandariya Mahadeva temple at Khajuraho has exactly this soaring curvilinear shikhara, so it belongs to the Nagara style.

**Why the other options are wrong:**

- Dravidian (South Indian) temples have a stepped, pyramidal tower (vimana), not a curvilinear one.
- Vesara is a hybrid of Nagara and Dravidian found in the Deccan, not the pure curvilinear form described.
- Indo-Saracenic is a colonial-era revival style, not a classical temple type.

**Final Answer:** Nagara style $\Rightarrow$ C

**Answer: (C)** Go Back to Q1

**Q2.**

**Solution**

**Concept – the parts of a Dravidian temple complex:** A South Indian temple is a walled enclosure entered through monumental gateways.

**Step 1 – identify the gateway:** The tall, tapering, richly sculpted gateway tower over the entrance in the enclosure wall is the **gopuram**. In large temples (Madurai, Srirangam) the gopurams grew to dominate the skyline.

**Step 2 – distinguish it from the sanctum tower:** The tower over the sanctum itself is the vimana; the gopuram is over the *gate*.

**Why the other options are wrong:**

- The shikhara is the curvilinear sanctum tower of North Indian (Nagara) temples.
- The amalaka is the ribbed stone disc at the top of a Nagara shikhara.
- A torana is a free-standing ceremonial gateway/arch (as at Sanchi), not the

Dravidian entrance pyramid.

**Final Answer:** Gopuram $\Rightarrow$ B

**Answer: (B)** Go Back to Q2

## Q3.

### Solution

**Concept – Chandigarh and its master planner:** Chandigarh, the post-Independence capital of Punjab, was master-planned by a European modernist invited by Nehru.

**Step 1 – recall the planner: Le Corbusier** laid out the city on a grid of "sectors" and designed the monumental Capitol Complex (Assembly, Secretariat, High Court).

**Step 2 – identify the emblem:** The **Open Hand** monument – "open to give and open to receive" – was Le Corbusier's own symbol for the city and stands in the Capitol Complex.

**Why the other options are wrong:**

- Louis Kahn worked in India at Ahmedabad (IIM), not at Chandigarh.
- Edwin Lutyens planned New Delhi, an earlier imperial capital.
- Otto Koenigsberger advised on several Indian towns but did not conceive the Open Hand.

**Final Answer:** Le Corbusier $\Rightarrow$ A

**Answer: (A)** Go Back to Q3

## Q4.

### Solution

**Concept – modern institutional architecture in India:** Several landmark campuses of the 1960s were designed by visiting masters of the Modern Movement.

**Step 1 – recall the architect of IIM Ahmedabad:** The IIM Ahmedabad campus, with its powerful exposed load-bearing brickwork, large circular and segmental arch openings and shaded corridors, was designed by **Louis Kahn**.

**Step 2 – note the collaboration:** B. V. Doshi was the local associate architect who helped realise the project, but the design authorship is Kahn's.

**Why the other options are wrong:**

- B. V. Doshi designed CEPT and Aranya housing; here he was Kahn's collaborator, not the designer.
- Charles Correa designed the Gandhi Ashram museum and Kanchanjunga apartments, not IIM-A.
- Le Corbusier worked at Chandigarh and Ahmedabad (Mill Owners' building), but not the IIM.

**Final Answer:** Louis Kahn $\Rightarrow$ C

**Answer: (C)** Go Back to Q4

## Q5.

### Solution

**Concept – the Mughal garden layout:** Mughal gardens follow a strict geometric, water-based Persian tradition.

**Step 1 – read the figure:** A square garden is split into four equal quarters by two axial water channels crossing at the centre, often with a central tank or platform at the crossing.

**Step 2 – name it:** This four-fold plan is the **char-bagh** (literally "four gardens"), the signature Mughal garden form seen at the Taj Mahal, Humayun's Tomb and the Shalimar Bagh.

**Why the other options are wrong:**

- A baradari is a twelve-doored open garden pavilion, not the garden layout itself.
- The Diwan-i-Khas is the hall of private audience in a Mughal palace.
- The Charminar is a monumental gateway with four minarets at Hyderabad, unrelated to garden planning.

**Final Answer:** Char-bagh $\Rightarrow$ A

**Answer: (A)** Go Back to Q5

## Q6.

**Solution**

**Concept – the sanctum tower of a Dravidian temple:** In the South Indian idiom the tower over the garbhagriha is built quite differently from the Nagara shikhara.

**Step 1 – read the figure:** A stepped, pyramidal tower rises in clearly marked receding storeys (talas) over the sanctum, tapering to a small domed finial.

**Step 2 – name it:** This pyramidal sanctum tower is the **vimana**. Its crowning domical member is the shikhara in South Indian usage, but the whole receding-storey tower is the vimana.

**Why the other options are wrong:**

- In North Indian usage the shikhara is the whole curvilinear tower; here the tower is stepped and pyramidal, i.e. a vimana.
- A mandapa is a pillared hall in front of the sanctum, not a tower.
- A gopuram is the gateway tower in the enclosure wall, not the sanctum tower.

**Final Answer:** Vimana $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q6

## Q7.

**Solution**

**Concept – pioneers of modern Indian architecture:** A generation of Indian architects developed a climate-responsive, culturally rooted modernism after Independence.

**Step 1 – recall the idea of open-to-sky space: Charles Correa** argued that in a warm climate the open-to-sky terrace, courtyard and verandah are as important as enclosed rooms, and made them central to his work.

**Step 2 – match the building:** He designed the Vidhan Bhavan (State Assembly) at Bhopal, organised around courtyards and mandala-like geometry.

**Why the other options are wrong:**

- Raj Rewal is known for the Asian Games Village and Hall of Nations, Delhi.
- Achyut Kanvinde designed institutional campuses such as IIT Kanpur, in a Brutalist idiom.
- Joseph Allen Stein designed the India International Centre and the "Steinabad" Lodi estate buildings.

**Final Answer:** Charles Correa $\Rightarrow$ A

**Answer: (A)** Go Back to Q7

## Q8.

### Solution

**Concept – ordering principles of architectural composition:** Standard principles (after Ching) include axis, symmetry, hierarchy, rhythm, datum and transformation.

**Step 1 – read the description:** A continuous line, plane or volume that ties together and gives order to a scattered set of forms is described.

**Step 2 – name the principle:** This is the **datum** – a reference element (a spine, base line, wall or field) that organises other elements by its constant, continuous presence.

**Why the other options are wrong:**

- Hierarchy is the visual emphasis of one element over others by size, shape or position.
- Rhythm is the regular or harmonic repetition of elements.
- Symmetry is the balanced disposition of equal elements about an axis or point, a stronger and more specific condition than a mere organising datum.

**Final Answer:** Datum $\Rightarrow$ A

**Answer: (A)** Go Back to Q8

## Q9.

### Solution

**Concept – grade designation of concrete in IS 456:** Concrete is graded by its characteristic compressive strength.

**Step 1 – decode the "M" and the number:** "M" stands for *mix*, and the number is the **characteristic compressive strength** in $\text{N/mm}^2$ (MPa) of $150$ mm cubes at $28$ days.

**Step 2 – apply to M25:** So M25 means a characteristic cube strength of $25\ \text{N/mm}^2$ at $28$ days – the value below which not more than $5\%$ of test results are expected to fall.

**Why the other options are wrong:**

- The strength is quoted at 28 days, not 7 days.
- The unit is N/mm$^2$ (MPa), not kN/mm$^2$, which would be a thousand times larger.
- "M25" is a strength grade, not a fixed volumetric mix ratio.

**Final Answer:** 25 N/mm$^2$ at 28 days $\Rightarrow$ D

**Answer: (D)** Go Back to Q9

## Q10.

### Solution

**Concept – Abrams' water–cement ratio law:** The single most important factor controlling the strength of fully compacted concrete is well established.

**Step 1 – state the law:** Abrams' law states that, for given materials and full compaction, the compressive strength of concrete depends only on the **water–cement ratio**: strength falls as the w/c ratio rises.

**Step 2 – explain the mechanism:** Excess mixing water, beyond that needed for hydration, leaves capillary pores in the hardened paste; more pores mean lower strength and durability.

**Why the other options are wrong:**

- Cement content matters, but at a fixed w/c ratio simply adding cement (and water) does not raise strength; it is the ratio that governs.
- Aggregate colour has no bearing on strength.
- The sand's fineness modulus affects workability and grading, not the fundamental strength law.

**Final Answer:** the water–cement ratio $\Rightarrow$ D

**Answer: (D)** Go Back to Q10

## Q11.

### Solution

**Concept – nominal mixes of concrete:** For small works IS permits nominal (volume-batched) mixes tied to grade.

**Step 1 – recall the standard nominal mixes:** 1 : 2 : 4 corresponds to M15, 1 : 1.5 : 3 to M20 and 1 : 1 : 2 to M25.

**Step 2 – pick M20:** Hence the nominal mix for **M20** is 1 : 1.5 : 3 (cement : fine

aggregate : coarse aggregate).

**Why the other options are wrong:**

- $1 : 1 : 2$ is the richer M25 nominal mix.
- $1 : 3 : 6$ is a lean mix (about M10), used for levelling courses.
- $1 : 2 : 4$ is the M15 nominal mix, one grade below M20.

**Final Answer:** $1 : 1.5 : 3 \Rightarrow$ C

**Answer: (C)** Go Back to Q11

## Q12.

### Solution

**Concept – nominal cover to reinforcement:** Cover protects steel from corrosion and fire and is fixed by the exposure condition.

**Step 1 – recall the moderate-exposure value:** For reinforced concrete under *moderate* exposure, IS 456 specifies a nominal clear cover of **30 mm** to the main reinforcement of a beam.

**Step 2 – place it among exposures:** Cover increases with severity – about $20$ mm for mild, $30$ mm for moderate, $45$ mm for severe and $50$–$75$ mm for very severe/marine, and reaches $75$ mm for members cast against earth (e.g. footings).

**Why the other options are wrong:**

- $15$ mm is below the code minimum for a beam and gives poor durability/fire cover.
- $75$ mm applies to foundations cast against soil, not a normal beam at moderate exposure.
- $5$ mm is far too small to protect the bars.

**Final Answer:** $30$ mm $\Rightarrow$ B

**Answer: (B)** Go Back to Q12

## Q13.

**Solution**

**Concept – the slump test as a measure of workability:** The slump is the drop in height of a standard cone of concrete after the mould is removed.

**Step 1 – interpret the measured slump:** A very stiff mix hardly slumps (0–25 mm), while a very wet mix slumps a great deal or collapses. A slump of 75–100 **mm** indicates *medium* workability.

**Step 2 – link to use:** Medium workability is suitable for ordinary reinforced-concrete work – beams, slabs and columns – where the concrete must flow around reinforcement yet resist segregation.

**Why the other options are wrong:**

- Very low (near-zero) slump describes stiff mixes for road pavements or vibrated precast work, not 75–100 mm.
- An extremely dry, unmixable batch would give essentially no slump.
- A collapsed, segregated concrete corresponds to an excessive slump, not the medium range.

**Final Answer:** medium (good) workability $\Rightarrow$ C

**Answer: (C)** Go Back to Q13

## Q14.

**Solution**

**Concept – curing of concrete:** Curing keeps concrete moist so that cement hydration can continue and strength can develop.

**Step 1 – recall the minimum period:** For ordinary Portland cement under normal weather, IS 456 requires curing (continuous moisture) for at least **7 days**.

**Step 2 – note the exceptions:** For concretes with mineral admixtures (e.g. blended cements) or in hot/arid conditions, the minimum extends to about 10–14 days, but the baseline for OPC is 7 days.

**Why the other options are wrong:**

- 1 day is far too short; strength gain would be badly stunted and the surface would craze.
- 90 days is a testing age for long-term strength, not a required curing minimum.
- 2 hours is only around the setting time, not curing.

**Final Answer:** 7 days $\Rightarrow$ A

**Answer: (A)** Go Back to Q14

## Q15.

### Solution

**Concept – project scheduling tools:** Construction programmes are shown either as bar charts or as network diagrams.

**Step 1 – read the figure:** Each activity (A, B, C, D) is a horizontal bar drawn against a time axis, and the length of each bar equals the activity's duration; overlaps show parallel work.

**Step 2 – name it:** A time-scaled bar chart of this kind is a **Gantt chart**, introduced by Henry Gantt and still the commonest way to display a construction schedule.

**Why the other options are wrong:**

- A pie chart shows proportions of a whole, not activities against time.
- A mass-haul diagram is an earthwork cut-and-fill balancing tool in road design.
- A histogram shows the frequency distribution of a variable (e.g. resource use), not scheduled bars.

**Final Answer:** Gantt (bar) chart $\Rightarrow$ D

**Answer: (D)** Go Back to Q15

## Q16.

### Solution

**Concept – static determinacy of a plane truss:** A truss is determinate when the number of unknowns equals the number of equilibrium equations available at its joints.

**Step 1 – count the unknowns and equations:** Unknowns are the $m$ member forces plus the $r$ reaction components. At each of the $j$ joints two equations of equilibrium ($\sum F_x = 0$, $\sum F_y = 0$) are available, giving $2j$ equations.

**Step 2 – write the determinacy condition:** For a just-rigid (statically determinate) plane truss:

$$m + r = 2j.$$

**Step 3 – interpret the imbalance:** If $m + r > 2j$ the truss is indeterminate; if

$m + r < 2j$ it is a mechanism (unstable).

**Why the other options are wrong:**

- $m + r = 3j - 3$ is not the truss condition ($3j$ would apply to rigid-body equilibrium of frames, not pin-joints).
- $m = 2j + r$ and $m + j = 2r$ do not correctly balance member forces, reactions and joint equations.

**Final Answer:** $m + r = 2j \Rightarrow$ B

**Answer: (B)** Go Back to Q16

## Q17.

### Solution

**Concept – method of joints:** At any pin joint the members and applied loads are in equilibrium, so $\sum F_x = 0$ and $\sum F_y = 0$.

**Step 1 – list what acts at joint $A$:** A downward load of $20$ kN, a horizontal member (force purely horizontal) and an inclined member at $30^\circ$ to the horizontal.

**Step 2 – resolve vertically:** Only the inclined member has a vertical component. Let its axial force be $F$. Vertical equilibrium:

$$F \sin 30^\circ = 20.$$

**Step 3 – substitute $\sin 30^\circ = 0.5$:**

$$0.5\, F = 20.$$

**Step 4 – solve for $F$:**

$$F = \frac{20}{0.5} = 40 \text{ kN}.$$

**Step 5 – interpret:** The inclined member carries $40$ kN (it pushes up on the joint, so it is in compression); the horizontal member then balances its horizontal component.

**Why the other options are wrong:**

- $20$ kN wrongly equates the member force to the load, ignoring the $30^\circ$ inclination.
- $10$ kN uses $F = 20 \sin 30^\circ$ instead of $F = 20/\sin 30^\circ$.
- $34.6$ kN uses $\cos 30^\circ$ (i.e. $20/\cos 30^\circ$), which resolves the wrong component.

**Final Answer:** $F = 40$ kN $\Rightarrow$ A

**Answer: (A)** Go Back to Q17

## Q18.

### Solution

**Concept – long-span roofing systems:** Large column-free spaces are roofed by triangulated three-dimensional networks.

**Step 1 – describe the system:** A **space frame** is a rigid, lightweight three-dimensional truss made of many short members joined at nodes, typically forming repeating tetrahedra or octahedra, so that loads are shared in all directions.

**Step 2 – note its advantage:** Because load is distributed three-dimensionally, a space frame roofs very large spans (airports, stadia, exhibition halls) with little material.

**Why the other options are wrong:**

- A shear wall is a planar element resisting in-plane lateral loads, not a 3-D roof grid.
- A portal frame is a 2-D rigid frame of columns and a beam/rafter.
- A catenary cable is a tension-only curved cable, a different long-span principle.

**Final Answer:** Space frame $\Rightarrow$ C

**Answer: (C)** Go Back to Q18

## Q19.

### Solution

**Concept – reactions of a simply supported beam under UDL:** For a symmetric load the two supports share the total load equally.

**Step 1 – find the total load:** Total load $W = w \times L = 5 \times 8 = 40$ kN.

**Step 2 – use symmetry:** The UDL is symmetric about mid-span, so each reaction carries half:

$$R_A = R_B = \frac{W}{2}.$$

**Step 3 – substitute:**

$$R_A = R_B = \frac{40}{2}.$$

**Step 4 – evaluate:**

$$R_A = R_B = 20 \text{ kN}.$$

**Why the other options are wrong:**

- 40 kN is the *total* load, not one reaction.
- 10 kN would be a quarter of the load, which is not the case for two supports.
- 5 kN is merely the load intensity per metre.

**Final Answer:** 20 kN at each support $\Rightarrow$ B

**Answer: (B)** Go Back to Q19

## Q20.

### Solution

**Concept – Euler's buckling load:** A slender column fails not by crushing but by sudden lateral buckling.

**Step 1 – write Euler's formula:**

$$P_{cr} = \frac{\pi^2 EI}{L_e^2},$$

where $E$ is the modulus of elasticity, $I$ the least moment of inertia and $L_e$ the effective length.

**Step 2 – read the dependence on length:** $L_e^2$ appears in the denominator, so $P_{cr}$ is *inversely proportional to the square of the effective length*.

**Step 3 – interpret:** Doubling the effective length reduces the buckling load to one-quarter; this is why slender columns are so much weaker.

**Why the other options are wrong:**

- $P_{cr}$ depends on the moment of inertia $I$, not simply the cross-sectional area.
- It varies with the square of the length, not its square root.
- $P_{cr}$ is *directly* proportional to $E$, not inversely.

**Final Answer:** the square of the effective length $\Rightarrow$ A

**Answer: (A)** Go Back to Q20

## Q21.

**Solution**

**Concept – bending moment at the fixed end of a cantilever under UDL:** The support must resist the moment of the whole distributed load about itself.

**Step 1 – find the total load and its line of action:** Total load $W = w \times L = 8 \times 3 = 24$ kN, acting at the centroid of the UDL, i.e. at mid-span, $L/2 = 1.5$ m from the fixed end.

**Step 2 – write the fixed-end moment:**

$$M = W \times \frac{L}{2} = (wL) \times \frac{L}{2} = \frac{wL^2}{2}.$$

**Step 3 – substitute the values:**

$$M = \frac{8 \times 3^2}{2}.$$

**Step 4 – compute $3^2$:**

$$M = \frac{8 \times 9}{2}.$$

**Step 5 – evaluate:**

$$M = \frac{72}{2} = 36 \text{ kN} \cdot \text{m (hogging)}.$$

**Why the other options are wrong:**

- $24$ kN·m is the total load in kN, not the moment.
- $12$ kN·m uses a lever arm of $L/4$ or halves the correct result.
- $72$ kN·m is $wL^2$ (forgetting the factor $\frac{1}{2}$).

**Final Answer:** $M = 36$ kN·m $\Rightarrow$ B

**Answer: (B)** Go Back to Q21

## Q22.

**Solution**

**Concept – solar altitude from a shadow:** A vertical object and its shadow form a right triangle whose base angle is the sun's altitude.

**Step 1 – set up the tangent relation:**

$$\tan \alpha = \frac{\text{object height}}{\text{shadow length}} = \frac{3}{4}.$$

**Step 2 – evaluate the ratio:**

$$\tan\alpha = 0.75.$$

**Step 3 – take the inverse tangent:**

$$\alpha = \tan^{-1}(0.75).$$

**Step 4 – read the standard 3-4-5 angle:** The $3$-$4$-$5$ right triangle has its smaller acute angle equal to about $36.87^\circ$, so

$$\alpha \approx 37^\circ.$$

**Why the other options are wrong:**

- $53^\circ$ is the *other* acute angle of the $3$-$4$-$5$ triangle ($\tan^{-1}(4/3)$), i.e. it inverts the ratio.
- $45^\circ$ would need equal height and shadow ($\tan\alpha = 1$).
- $30^\circ$ corresponds to $\tan\alpha = 0.577$, not $0.75$.

**Final Answer:** $\alpha \approx 37^\circ \Rightarrow$ D

**Answer: (D)** Go Back to Q22

## Q23.

**Solution**

**Concept – Sabine's reverberation-time formula:**

$$\mathrm{RT}_{60} = \frac{0.161\,V}{A},$$

with $V$ the room volume in $\mathrm{m}^3$ and $A$ the total absorption in metric sabins.

**Step 1 – list the data:** $V = 600\ \mathrm{m}^3$, $A = 60$ sabins.

**Step 2 – compute the numerator:**

$$0.161 \times 600 = 96.6.$$

**Step 3 – divide by the absorption:**

$$\mathrm{RT}_{60} = \frac{96.6}{60}.$$

**Step 4 – evaluate:**

$$\mathrm{RT}_{60} = 1.61 \text{ s}.$$

**Why the other options are wrong:**

- $0.80$ s would need about double the absorption ($A \approx 120$).
- $2.42$ s corresponds to half the absorption ($A \approx 40$).
- $3.20$ s corresponds to $A \approx 30$ sabins, not $60$.

**Final Answer:** $\mathrm{RT}_{60} \approx 1.61$ s $\Rightarrow$ C

**Answer: (C)** Go Back to Q23

## Q24.

### Solution

**Concept – thermal transmittance of a building element:** Heat flow through a wall or roof under steady conditions is characterised by a single coefficient.

**Step 1 – define the U-value:** The **U-value** (thermal transmittance) is the steady heat-flow rate through unit area of the element per unit temperature difference between the two sides, in W/m$^2$K.

**Step 2 – relate to resistance:** It is the reciprocal of the total thermal resistance: $U = 1/R_{\text{total}}$. A *low* U-value means a well-insulated element.

**Why the other options are wrong:**

- The R-value is the thermal *resistance* (m$^2$K/W), the inverse of U, not the transmittance asked for.
- Albedo is the fraction of solar radiation reflected by a surface.
- Time lag is the delay between peak outdoor and peak indoor temperature, a dynamic property, not the W/m$^2$K coefficient.

**Final Answer:** U-value (thermal transmittance) $\Rightarrow$ A

**Answer: (A)** Go Back to Q24

## Q25.

**Solution**

**Concept – the daylight factor:** Daylighting is judged not by an absolute lux value but by a ratio, because the sky brightness varies.

**Step 1 – state the definition:**

$$\text{Daylight factor} = \frac{\text{indoor illuminance at the point}}{\text{simultaneous outdoor illuminance from an unobstructed overcast sky}} \times 100\%$$

**Step 2 – explain the reference sky:** The standard CIE *overcast* sky is used because it is symmetric and does not depend on sun position, giving a stable, worst-case reference.

**Why the other options are wrong:**

- Comparing to the artificial lighting would confuse daylight with electric light.
- Comparing to a value one year earlier is meaningless; the two readings must be simultaneous.
- Direct beam sunlight is deliberately excluded; the reference is the diffuse overcast sky.

**Final Answer:** simultaneous outdoor illuminance from an overcast sky $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q25

## Q26.

**Solution**

**Concept – the ton of refrigeration:** Cooling capacity is historically measured by the ice-melting rate.

**Step 1 – recall the definition:** One ton of refrigeration is the heat absorbed in melting one short ton $(2000$ lb) of ice at $0°$C in $24$ hours.

**Step 2 – convert to SI power:** This works out to about $12000$ Btu/h, which is

$$1 \text{ TR} \approx 3.517 \text{ kW} \approx 3.5 \text{ kW}.$$

**Why the other options are wrong:**

- $1.0$ kW badly understates the capacity of one ton.
- $0.10$ kW is off by a factor of about $35$.

- $0.746$ kW is $1$ horsepower, an unrelated (mechanical power) unit.

**Final Answer:** $\approx 3.5$ kW $\Rightarrow$ D

**Answer: (D)** Go Back to Q26

## Q27.

### Solution

**Concept – insulation against airborne sound:** Acoustic performance is split into *absorption* (within a room) and *insulation* (between rooms).

**Step 1 – name the measure:** A partition's resistance to airborne sound passing through it is its **sound reduction index** (rated as the Sound Transmission Class, STC), expressed in decibels.

**Step 2 – recall the mass law:** Insulation improves with the mass per unit area of the partition (roughly $+6$ dB for each doubling of mass), and with discontinuity such as cavity construction.

**Why the other options are wrong:**

- Reverberation time describes how long sound persists *within* a room, not transmission between rooms.
- The absorption coefficient measures how much sound a surface soaks up, aiding room acoustics, not partition insulation.
- The glare index is a lighting-quality measure, not acoustic.

**Final Answer:** Sound Transmission Class / sound reduction index $\Rightarrow$ A

**Answer: (A)** Go Back to Q27

## Q28.

### Solution

**Concept – gradients for building drainage:** A waste pipe must slope enough to keep a self-cleansing velocity yet not so steep that water outruns the solids.

**Step 1 – recall the rule of thumb:** For a $100$ mm diameter soil/waste pipe, a minimum gradient of about $1$ **in** $40$ is commonly adopted; $150$ mm pipes need a flatter $1$ in $60$, and smaller $75$ mm pipes a steeper gradient.

**Step 2 – state the purpose:** This slope maintains a self-cleansing velocity of roughly $0.6$–$0.9$ m/s so that solids are carried along and not deposited.

**Why the other options are wrong:**

- 1 in 5 is far too steep; water would race ahead and leave solids behind.
- 1 in 500 is too flat for a 100 mm pipe and would silt up.
- A dead-flat pipe cannot drain by gravity at all.

**Final Answer:** 1 in 40 $\Rightarrow$ B

**Answer: (B)** Go Back to Q28

## Q29.

### Solution

**Concept – key texts of 20th-century urbanism:** Several authors reshaped how we think about cities and streets.

**Step 1 – attribute the book:** *The Death and Life of Great American Cities* (1961) was written by **Jane Jacobs**, a journalist-activist.

**Step 2 – recall its argument:** She criticised slum-clearance and expressway-driven "urban renewal" and praised dense, fine-grained, mixed-use streets where constant activity provides "eyes on the street" and safety.

**Why the other options are wrong:**

- Kevin Lynch wrote *The Image of the City* (mental maps, five elements).
- Gordon Cullen wrote *The Concise Townscape* (serial vision).
- Camillo Sitte wrote *City Planning According to Artistic Principles* on the design of squares.

**Final Answer:** Jane Jacobs $\Rightarrow$ B

**Answer: (B)** Go Back to Q29

## Q30.

### Solution

**Concept – linear open-space systems:** Open space can be organised as compact parks or as linear corridors linking them.

**Step 1 – define the corridor:** A **greenway** is a linear strip of protected open space – along a river, ridge, canal or old rail line – kept for recreation, walking and cycling, and for ecological connectivity.

**Step 2 – note its value:** Greenways stitch together parks and neighbourhoods,

offering continuous non-motorised routes and wildlife corridors through the built-up area.

**Why the other options are wrong:**

- A cul-de-sac is a dead-end residential street, not an open-space corridor.
- A piazza is a hard-paved urban square, a point space rather than a linear one.
- A roundabout is a traffic-circulation island.

**Final Answer:** Greenway $\Rightarrow$ C

**Answer: (C)** Go Back to Q30

## Q31.

### Solution

**Concept – transit-oriented development (TOD):** TOD is a planning response to sprawl and car dependence, built around mass transit.

**Step 1 – state the core idea:** TOD concentrates **compact, mixed-use, walkable** development within a comfortable walking distance (about 500–800 m) of a transit station, so that many trips can be made on foot, by cycle or by transit.

**Step 2 – list its features:** Higher densities near the station, a fine street grid, active ground-floor uses, reduced parking and good pedestrian connections are typical TOD ingredients now written into Indian metro-corridor policies.

**Why the other options are wrong:**

- Low-density car-dependent sprawl away from stations is exactly what TOD seeks to avoid.
- Single-use peripheral industrial estates are the opposite of mixed-use transit nodes.
- Gated enclaves cut off from transit contradict TOD's goal of accessibility.

**Final Answer:** compact, mixed-use, walkable development near transit $\Rightarrow$ C

**Answer: (C)** Go Back to Q31

## Q32.

**Solution**

**Concept – enclosure and the height-to-width ratio of urban space:** The feeling of an outdoor room depends on how tall its walls are relative to how far apart they stand.

**Step 1 – read the ratio:** With building height $H$ and space width $D$, a ratio of about $H : D = 1 : 2$ to $1 : 3$ (the observer can take in the enclosing facades comfortably within the normal cone of vision) gives a pleasant, well-defined **sense of enclosure** suited to a public square.

**Step 2 – note the extremes:** If $H : D$ approaches $1 : 1$ or higher the space feels tight and canyon-like; if it falls below about $1 : 4$ the enclosure weakens and the space feels like undefined open ground.

**Why the other options are wrong:**

- A claustrophobic canyon results from a much *higher* ratio (tall buildings, narrow gap).
- "No spatial definition" happens when the ratio is far too low (very wide, low edges).
- A tunnel-like corridor is a linear, tightly enclosed form, not the square described.

**Final Answer:** a comfortable sense of enclosure for a square $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q32

## Q33.

**Solution**

**Concept – the urban heat island:** Cities modify their own climate through their surfaces and metabolism.

**Step 1 – describe the phenomenon:** An **urban heat island** is the tendency of a built-up area to be several degrees warmer than the surrounding countryside, most noticeably at night.

**Step 2 – state the causes:** Dark paving and roofs absorb and re-radiate heat, buildings trap radiation in "canyons", vegetation and evaporative cooling are reduced, and vehicles, air-conditioners and industry add waste heat.

**Why the other options are wrong:**

- An urban canyon is the street-and-buildings geometry that contributes to the

effect, not the temperature phenomenon itself.

- An urban village is a socially cohesive inner-city community, not a thermal condition.
- Urban sprawl is low-density outward growth, a land-use pattern, not the warming effect.

**Final Answer:** urban heat island $\Rightarrow$ C

**Answer: (C)** Go Back to Q33

## Q34.

### Solution

**Concept – Floor Space Index (FSI / FAR):** FSI caps the total floor area that may be built on a plot:

$$\text{FSI} = \frac{\text{total built-up floor area}}{\text{plot area}}.$$

**Step 1 – rearrange for floor area:**

$$\text{total floor area} = \text{FSI} \times \text{plot area}.$$

**Step 2 – list the data:** Plot area $= 800\ \text{m}^2$, FSI $= 2.0$.

**Step 3 – substitute:**

$$\text{total floor area} = 2.0 \times 800.$$

**Step 4 – evaluate:**

$$\text{total floor area} = 1600\ \text{m}^2.$$

**Step 5 – interpret:** This $1600\ \text{m}^2$ may be spread over several floors inside the setback envelope (for example four floors of $400\ \text{m}^2$ each), but the total is capped at $1600\ \text{m}^2$.

**Why the other options are wrong:**

- $400\ \text{m}^2$ divides the plot by FSI instead of multiplying.
- $800\ \text{m}^2$ is the plot area itself (FSI $= 1$).
- $1200\ \text{m}^2$ uses FSI $= 1.5$, not $2.0$.

**Final Answer:** $1600\ \text{m}^2 \Rightarrow$ D

**Answer: (D)** Go Back to Q34

## Q35.

**Solution**

**Concept – the hierarchy of statutory town plans in India:** Development plans nest from broad, long-term frameworks down to detailed layouts.

**Step 1 – identify the top-level plan:** The **Master (Development) Plan** sets the long-term (about 20–25 year) vision: land-use zoning, the road and transport network, and reservations for major infrastructure and public uses.

**Step 2 – place the others below it:** Zonal plans elaborate the master plan for a sub-area, and layout plans fix individual plot and street details; both must conform to the master plan.

**Why the other options are wrong:**

- A zonal plan is a mid-level plan derived from the master plan, not the parent document.
- A layout plan deals with plot subdivision and internal roads at the smallest scale.
- An annual action plan is a short-term implementation/budget document, not the long-range spatial plan.

**Final Answer:** Master (Development) Plan $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q35

## Q36.

**Solution**

**Concept – approaches to affordable housing:** Housing agencies can deliver either finished units or serviced land for self-build.

**Step 1 – describe the approach:** In a **site-and-services scheme** the agency lays out plots with basic trunk services – water, sewerage, roads, sometimes a sanitary core or one built room – and hands them to beneficiaries, who then build the house incrementally as they can afford.

**Step 2 – note the rationale:** It stretches scarce public funds, uses the household's own labour and savings, and lets the dwelling grow over time; the Aranya scheme at Indore is a celebrated example.

**Why the other options are wrong:**

- A ready-built flats scheme delivers completed units, the opposite of incremental self-build.

- Transit housing is temporary accommodation during resettlement.
- Rental barracks provide dormitory-style rented rooms, not serviced ownership plots.

**Final Answer:** site-and-services scheme $\Rightarrow$ C

**Answer: (C)** Go Back to Q36

## Q37.

### Solution

**Concept – location theory of settlements:** Regional planning uses spatial theories to explain why towns form where and at the sizes they do.

**Step 1 – name the theory and author: Central Place Theory** was propounded by the German geographer **Walter Christaller** (1933).

**Step 2 – state its content:** Settlements act as "central places" offering goods and services to surrounding market (complementary) areas; higher-order centres (offering rarer goods) are fewer and farther apart, lower-order centres many and close, giving a nested hexagonal hierarchy.

**Why the other options are wrong:**

- Ebenezer Howard proposed the Garden City, a design ideal, not a location theory.
- Patrick Geddes is known for regional survey and "survey before plan".
- Clarence Perry devised the Neighbourhood Unit, a residential-cell concept.

**Final Answer:** Walter Christaller $\Rightarrow$ D

**Answer: (D)** Go Back to Q37

## Q38.

### Solution

**Concept – gross residential density:** Density is population divided by the land area that carries it.

**Step 1 – write the relation:**

$$\text{gross density} = \frac{\text{population}}{\text{gross area}}.$$

**Step 2 – list the data:** Population $= 12000$ persons; gross area $= 40$ ha.

**Step 3 – substitute:**

$$\text{gross density} = \frac{12000}{40}.$$

**Step 4 – evaluate:**

$$\text{gross density} = 300 \text{ persons/ha}.$$

**Why the other options are wrong:**

- $150$ persons/ha would need $80$ ha, or half the population.
- $480$ persons/ha does not follow from the given figures.
- $200$ persons/ha would require $60$ ha, not $40$ ha.

**Final Answer:** $300$ persons/ha $\Rightarrow$ A

**Answer: (A)** Go Back to Q38

## Q39.

### Solution

**Concept – income categories in Indian housing policy:** Public housing is targeted by income group, using standard abbreviations.

**Step 1 – expand EWS:** "EWS" stands for **Economically Weaker Section**, the lowest income band, defined by an official annual-income ceiling.

**Step 2 – place it among the groups:** The usual ladder is EWS, then LIG (Low Income Group), MIG (Middle Income Group) and HIG (High Income Group); EWS units are the smallest and most subsidised, as under PMAY.

**Why the other options are wrong:**

- "Extra Wide Street" is not a housing category.
- "Eastern Water Supply" has nothing to do with income groups.
- "Environmental Work Standard" is not a recognised housing-policy term.

**Final Answer:** Economically Weaker Section $\Rightarrow$ C

**Answer: (C)** Go Back to Q39

## Q40.

**Solution**

**Concept – methods of plane-table surveying:** Points are fixed on the drawing sheet by different ray-drawing procedures.

**Step 1 – describe the method:** In **intersection**, the table is set up at two (or more) known stations; from each, a ray is drawn towards the same distant object, and the object is plotted where the two rays cross.

**Step 2 – note its use:** Intersection is ideal for locating inaccessible points (a tower, a tree across a river) whose distances cannot be measured directly, since only directions are needed.

**Why the other options are wrong:**

- Radiation fixes points by a ray *and* a measured distance from one station.
- Traversing runs a connected series of survey lines around or across the area.
- Resection fixes the position of the *instrument station* from known points, the reverse operation.

**Final Answer:** Intersection $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q40

## Q41.

**Solution**

**Concept – the total station instrument:** Modern survey combines angle and distance measurement in one electronic device.

**Step 1 – describe the total station:** A **total station** pairs an electronic theodolite (for horizontal and vertical angles) with an **electronic distance measurement (EDM)** unit (for slope distance) and an on-board microprocessor and data recorder.

**Step 2 – state what it yields:** From the measured angles and distance it computes horizontal distance, coordinates and reduced levels directly, and stores them for download to CAD/GIS.

**Why the other options are wrong:**

- A plane table and alidade is a separate, older graphical method, not part of a total station.
- A dumpy level measures only height differences, not angles and distances together.

- A magnetic compass gives only bearings, far short of a total station's capability.

**Final Answer:** an EDM unit and data recorder $\Rightarrow$ B

**Answer: (B)** Go Back to Q41

## Q42.

### Solution

**Concept – reduced level by the height-of-instrument method:**

$$\text{HI} = \text{RL of known point} + \text{BS}, \qquad \text{RL of new point} = \text{HI} - \text{FS}.$$

**Step 1 – list the data:** RL of benchmark $= 250.000$ m; back sight BS $= 2.250$ m; fore sight FS $= 1.150$ m.

**Step 2 – find the height of instrument:**

$$\text{HI} = 250.000 + 2.250 = 252.250 \text{ m}.$$

**Step 3 – subtract the fore sight:**

$$\text{RL of point} = 252.250 - 1.150.$$

**Step 4 – evaluate:**

$$\text{RL of point} = 251.100 \text{ m}.$$

**Step 5 – check by rise/fall:** BS $-$ FS $= 2.250 - 1.150 = +1.100$ m is a *rise*, so $250.000 + 1.100 = 251.100$ m, which agrees.

**Why the other options are wrong:**

- $248.900$ m subtracts the rise instead of adding it (treats a rise as a fall).
- $253.400$ m adds both readings $(250 + 2.25 + 1.15)$, i.e. adds the fore sight.
- $250.000$ m ignores the level difference entirely.

**Final Answer:** $251.100$ m $\Rightarrow$ A

**Answer: (A)** Go Back to Q42

## Q43.

**Solution**

**Concept – fixing the plane-table station itself:** Sometimes the unknown to be located is the position of the instrument, not an outside object.

**Step 1 – describe resection:** In **resection**, the observer draws rays back from the plane-table station towards two or more points of known plotted position; the station is located where those back-rays intersect on the sheet.

**Step 2 – note the common technique:** The three-point problem (using three known points, solved by the trial-and-error or Bessel/Lehmann method) is the classic resection procedure.

**Why the other options are wrong:**

- Radiation locates surrounding points *from* a known station, not the station itself.
- Intersection fixes an outside object from two known stations, the reverse of resection.
- Levelling determines heights, not the horizontal position of a station.

**Final Answer:** Resection $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q43

## Q44.

**Solution**

**Concept – the transverse profile of a road:** Roads are given a slight cross-slope so that rainwater does not stand on the carriageway.

**Step 1 – define camber: Camber** (or cross-fall) is the transverse slope provided from the crown at the road centre down to the two edges, so that surface water runs off quickly to the side drains.

**Step 2 – note typical values:** Camber is expressed as a percentage or ratio (for example $1$ in $50$ to $1$ in $40$ for a bituminous surface, steeper for gravel), chosen to drain water without making the surface uncomfortable.

**Why the other options are wrong:**

- Superelevation is the transverse slope raised on the *outer* edge at a curve to counter centrifugal force, a different purpose.
- Longitudinal gradient is the slope *along* the road, not across it.
- Right-of-way is the full width of land reserved for the road, not a slope.

**Final Answer:** Camber (cross-fall) $\Rightarrow$ B

**Answer: (B)** Go Back to Q44

## Q45.

### Solution

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

**Step 1 – identify the mode-choice stage:** The stage that splits the trips between competing modes – private car, bus, metro rail, walking – is **modal split**. It answers "by which mode?".

**Step 2 – contrast with the other stages:** Trip generation counts how many trips each zone produces/attracts; trip distribution pairs origins with destinations; traffic assignment loads the mode-specific trips onto particular routes.

**Why the other options are wrong:**

- Trip generation estimates trip *totals* per zone, not the mode share.
- Trip distribution links origins to destinations, not modes.
- Traffic assignment routes trips over the network links.

**Final Answer:** Modal split $\Rightarrow$ D

**Answer: (D)** Go Back to Q45

## Q46.

### Solution

**Concept – self-cleansing velocity in a sewer:** A sewer must flow fast enough to carry solids along and stop them settling.

**Step 1 – state the value:** The minimum **self-cleansing velocity** is generally taken as about $0.6$ **m/s** (commonly the range $0.6$–$0.9$ m/s at design flow) for sanitary sewers.

**Step 2 – explain the two-sided limit:** Below this, grit and organic solids settle and the sewer silts up; the gradient is therefore set so that even at minimum flow the velocity stays around $0.6$ m/s. At the same time a maximum velocity (about $3$ m/s) is not exceeded, to avoid scouring the pipe.

**Why the other options are wrong:**

- $0.1$ m/s is far too slow; solids would deposit at once.
- $3.0$ m/s is nearer the *maximum* (non-scouring) limit, not the minimum self-cleansing value.
- $10$ m/s is unrealistically high and would erode the sewer.

**Final Answer:** about $0.6$ m/s $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q46

# Answer Key

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