GATE Architecture and Planning

Sample Paper – 10

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 house "Fallingwater" (1935), dramatically cantilevered over a waterfall at Bear Run, Pennsylvania and celebrated as a masterpiece of organic architecture, was designed by: **[1 mark]**

(A) Frank Lloyd Wright

(B) Le Corbusier

(C) Alvar Aalto

(D) Louis Sullivan

Q2. The Barcelona Pavilion (1929), with its free-standing marble planes, chromed columns and reflecting pools, and the dictum "less is more", are associated with the architect: **[1 mark]**

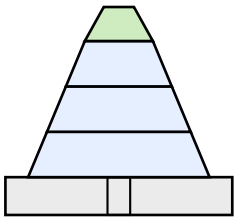
(A) Walter Gropius

(B) Philip Johnson

(C) Mies van der Rohe

(D) Le Corbusier

Q3. In South Indian (Dravidian) temple architecture, the tall, ornate, tapering entrance tower rising over the gateway of the temple enclosure, as sketched, is called the: **[1 mark]**



temple gateway tower

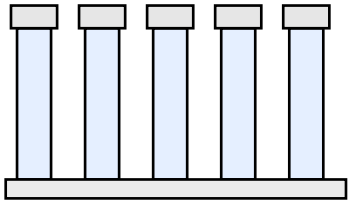
(A) Shikhara

(B) Gopuram

(C) Vimana

(D) Mandapa

Q4. The ordering principle of composition illustrated below, in which identical elements are repeated at regular, equal intervals to create a sense of movement, is called: **[1 mark]**



equal elements repeated at equal intervals

(A) Symmetry

(B) Rhythm

(C) Hierarchy

(D) Datum

Q5. The master plan of Chandigarh and the sculptural concrete buildings of its Capitol Complex – the Palace of Assembly, the High Court and the Secretariat – were designed by: [1 mark]

(A) Louis Kahn

(B) Edwin Lutyens

(C) Le Corbusier

(D) Otto Koenigsberger

Q6. The campus of the Indian Institute of Management, Ahmedabad, celebrated for its monumental exposed-brick geometry, arches and daylit corridors, was designed by: [1 mark]

(A) B.V. Doshi

(B) Charles Correa

(C) Le Corbusier

(D) Louis Kahn

Q7. The Indian architect who advocated "form follows climate" and the "open-to-sky space", and designed the Kanchanjunga Apartments (Mumbai) and Jawahar Kala Kendra (Jaipur), is: [1 mark]

(A) Raj Rewal

(B) Achyut Kanvinde

(C) Charles Correa

(D) B.V. Doshi

Q8. The Roman author of the treatise *De Architectura*, who held that a well-built work must possess *firmitas*, *utilitas* and *venustas* (firmness, commodity and delight), was: [1 mark]

(A) Vitruvius

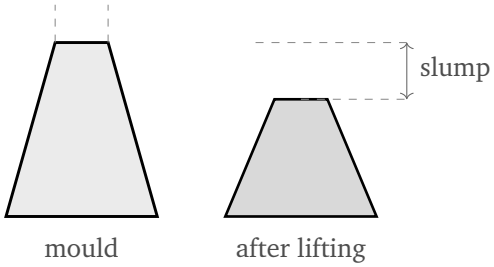
(B) Leon Battista Alberti

(C) Andrea Palladio

(D) Giacomo da Vignola

Building Construction, Materials and Management

Q9. On a construction site the *workability* (consistency) of a batch of freshly mixed concrete is most commonly measured with the apparatus shown, using the: **[1 mark]**



(A) Vicat apparatus test

(B) Slump cone test

(C) Le Chatelier soundness test

(D) Brinell hardness test

Q10. According to Abrams' law, for a fully compacted concrete made with sound aggregates, as the water-cement ratio of the mix is increased, the compressive strength of the hardened concrete: **[1 mark]**

(A) increases steadily

(B) remains constant

(C) decreases

(D) first increases and then remains constant

Q11. In the Programme Evaluation and Review Technique (PERT), an activity has an optimistic time $t_o = 4$ days, a most-likely time $t_m = 7$ days and a pessimistic time $t_p = 16$ days. Its expected (mean) duration t_e is: **[1 mark]**

(A) 9 days

(B) 7 days

(C) 6 days

(D) 8 days

Q12. Among the Bogue compounds of ordinary Portland cement, the one that is chiefly responsible for the *early* strength gain and that liberates a large heat of hydration is: **[1 mark]**

(A) Dicalcium silicate (C_2S)

(B) Tricalcium silicate (C_3S)

(C) Tetracalcium alumino-ferrite (C_4AF)

(D) Gypsum

Q13. The apparent increase in the volume of a heap of dry sand when a small amount of moisture is added to it (caused by a film of water forcing the grains apart) is called: **[1 mark]**

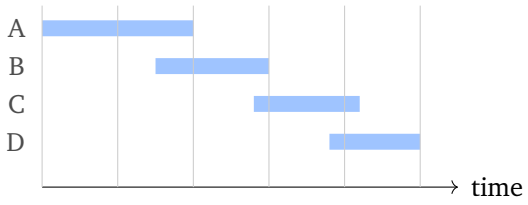
(A) Bulking of sand

(B) Bleeding

(C) Segregation

(D) Efflorescence

Q14. In construction project management, the scheduling chart shown below – in which each activity is drawn as a horizontal bar set against a common time scale – is a: **[1 mark]**



(A) Pie chart

(B) Gantt (bar) chart

(C) Network (arrow) diagram

(D) Mass-haul diagram

Q15. In the manufacture of plywood, successive wood veneers are glued together so that the grain direction of each ply runs, relative to that of the plies immediately next to it: **[1 mark]**

(A) parallel to one another

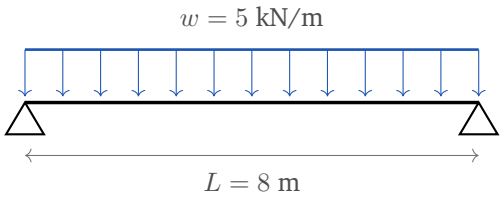
(B) inclined at 45°

(C) at right angles (perpendicular) to one another

(D) in random directions

Building Structures and Systems

Q16. A simply supported beam of span 8 m carries a uniformly distributed load of 5 kN/m over its entire length, as shown. The maximum bending moment (at midspan) is: **[1 mark]**



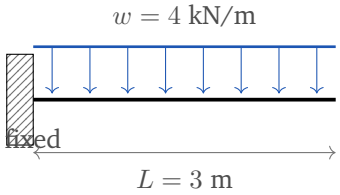
(A) 20 kN·m

(B) 80 kN·m

(C) 10 kN·m

(D) 40 kN·m

Q17. A cantilever beam of length 3 m carries a uniformly distributed load of 4 kN/m over its whole length, as shown. The magnitude of the shear force at the fixed support is: **[1 mark]**



(A) 12 kN

(B) 6 kN

(C) 18 kN

(D) 24 kN

Q18. A structure in which the number of unknown support reactions and internal forces exceeds the number of available equations of static equilibrium is said to be: [1 mark]

(A) unstable (a mechanism)

(B) statically determinate

(C) statically indeterminate

(D) a rigid body in free space

Q19. A long, slender axially loaded column tends to fail not by crushing of the material but by sudden lateral deflection at a critical load. This mode of failure is called: [1 mark]

(A) direct crushing

(B) shear failure

(C) torsional failure

(D) buckling

Q20. On a loaded beam, the section at which the bending moment is zero and changes its sign (from sagging to hogging or vice versa) is known as the point of: [1 mark]

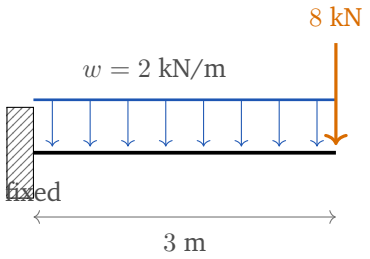
(A) contraflexure (inflexion)

(B) maximum shear

(C) fixity

(D) zero deflection

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



(A) 24 kN·m

(B) 33 kN·m

(C) 42 kN·m

(D) 30 kN·m

Environmental Design and Building Services

Q22. GRIHA, the national green-building rating system of India (developed by TERI with the Ministry of New and Renewable Energy), assesses a building on a 100-point scale and awards a rating up to a maximum of: **[2 marks]**

(A) 3 stars

(B) 5 stars

(C) 7 stars

(D) 4 stars

Q23. In the LEED (Leadership in Energy and Environmental Design) green-building rating system, the highest level of certification a project can achieve is: **[2 marks]**

(A) Gold

(B) Silver

(C) Platinum

(D) Diamond

Q24. Two independent (incoherent) machines each produce a sound-pressure level of 60 dB at a point. When both operate together, the combined sound-pressure level at that point is nearest to: **[2 marks]**

(A) 120 dB

(B) 66 dB

(C) 60 dB

(D) 63 dB

Q25. The sound-absorption coefficient α of a surface expresses the fraction of incident sound energy that it absorbs, and ranges from 0 to 1. For an ideal (perfect) absorber such as a wide open window, the value of α is taken as: **[2 marks]**

(A) 0

(B) 1

(C) 0.5

(D) 100

Q26. According to the "mass law" governing the airborne sound insulation of a single homogeneous partition, the transmission loss of the partition increases as one increases its: **[2 marks]**

(A) surface area

(B) porosity

(C) flexural stiffness

(D) surface mass (weight per unit area)

Q27. The IGBC green-building rating system, widely used for offices, homes and factories in India, is developed and administered by the: **[2 marks]**

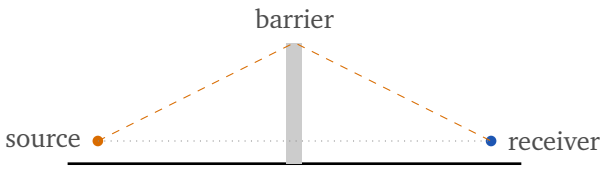
(A) Bureau of Indian Standards

(B) Confederation of Indian Industry (CII)

(C) Ministry of Housing and Urban Affairs

(D) National Building Construction Corporation

Q28. A solid barrier wall is erected between a noise source and a receiver, as shown. Such acoustic barriers are most effective at attenuating: **[2 marks]**



(A) high-frequency (short-wavelength) sound

(B) low-frequency sound

(C) infrasound only

(D) all frequencies equally

Urban Design and Landscape Architecture

Q29. The design of Central Park in New York and the coining of the very term "landscape architecture" as a profession are associated with: **[2 marks]**

(A) Lancelot "Capability" Brown

(B) André Le Nôtre

(C) Frederick Law Olmsted

(D) Ian McHarg

Q30. The overlay (sieve) mapping technique – superimposing separate maps of slope, soil, drainage, vegetation and other factors to find the most ecologically suitable land for development, set out in the book *Design with Nature* – was developed by: **[2 marks]**

(A) Ian McHarg

(B) Kevin Lynch

(C) Gordon Cullen

(D) Christopher Alexander

Q31. In Kevin Lynch's urban-design theory, the quality of a city by which its distinct parts are easily recognised and can be organised by an observer into a clear, coherent mental picture is termed its: **[2 marks]**

(A) permeability

(B) imageability (legibility)

(C) enclosure

(D) transparency

Q32. The formal, strictly geometric and axial garden style – with clipped parterres, long straight allees and grand water axes, epitomised by the gardens of Versailles – was created by: **[2 marks]**

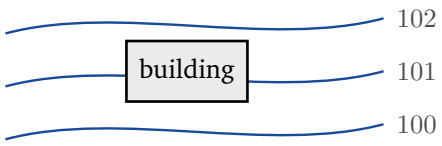
(A) André Le Nôtre

(B) Lancelot "Capability" Brown

(C) Frederick Law Olmsted

(D) Humphry Repton

Q33. In site planning on the sloping ground shown by the contours below, the most economical and environmentally sensitive way to place a building is by: **[2 marks]**



contours (m)

(A) grading the site to follow the existing land form, balancing cut and fill

(B) levelling the entire site to one flat plane

(C) disregarding the natural topography altogether

(D) enclosing the whole site behind tall retaining walls

Urban and Regional Planning and Housing

Q34. A residential area with a gross site area of 40 hectares accommodates a population of 12000 persons. The gross residential density of the area is: [2 marks]

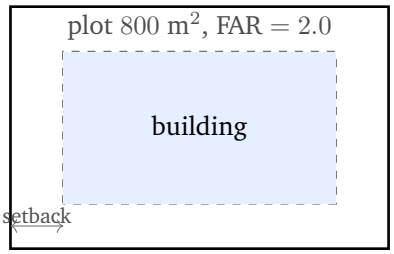
(A) 200 persons/ha

(B) 480 persons/ha

(C) 300 persons/ha

(D) 250 persons/ha

Q35. A plot of area 800 m^2 is granted a Floor Area Ratio (FAR / FSI) of 2.0, with the rectangular building envelope shown inside the setbacks. The maximum permissible total built-up (floor) area is: [2 marks]



(A) 400 m^2

(B) 800 m^2

(C) 1600 m^2

(D) 2400 m^2

Q36. The "Radburn layout" – large super-blocks with a hierarchy of roads, houses turned inward toward interior green spaces, and complete separation of pedestrian from vehicular movement – was designed by Clarence Stein together with: [2 marks]

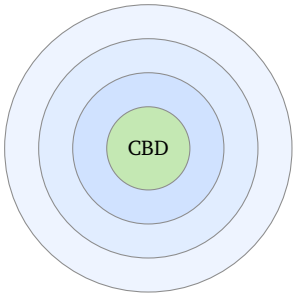
(A) Ebenezer Howard

(B) Clarence Perry

(C) Le Corbusier

(D) Henry Wright

Q37. The classical model of urban land use shown below – a Central Business District at the core, surrounded by successive concentric rings of transition, workers' housing, better residences and commuters – was proposed by: **[2 marks]**



concentric rings

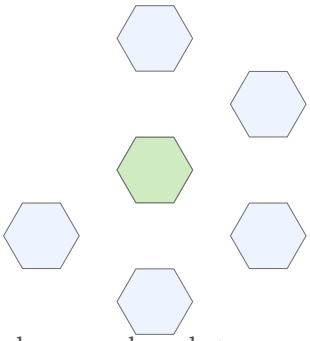
(A) Homer Hoyt

(B) Chauncy Harris and Edward Ullman

(C) Ernest Burgess

(D) Walter Christaller

Q38. The theory that explains the size, number and spacing of settlements in a region through a nested lattice of hexagonal market areas, as sketched, is the: **[2 marks]**


hexagonal market areas

(A) Central Place Theory (Christaller)

(B) Concentric Zone Theory

(C) Sector Theory

(D) Multiple Nuclei Theory

Q39. A housing programme in which the public authority provides only a serviced plot (with access road, water supply and sanitation) while the

beneficiary builds and extends the dwelling incrementally by self-help is called a: [2 marks]

(A) turnkey housing scheme

(B) public rental housing scheme

(C) cooperative group-housing scheme

(D) site-and-services scheme

Planning Techniques, Surveying and GIS

Q40. A "total station", now the standard instrument for detail and control surveys, is an electronic instrument that integrates a digital theodolite (for measuring angles) with: [2 marks]

(A) a satellite GPS receiver

(B) an electronic distance meter (EDM)

(C) a spirit level tube only

(D) a plane table and alidade

Q41. For a stand-alone GNSS/GPS receiver to compute a three-dimensional position fix (latitude, longitude and height), the minimum number of satellites it must observe simultaneously is: [2 marks]

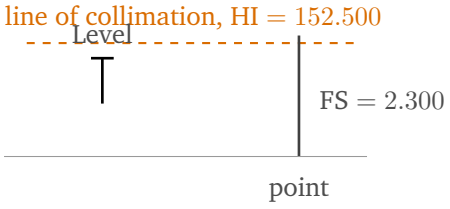
(A) 3

(B) 4

(C) 2

(D) 6

Q42. In levelling by the height-of-instrument method, the height of instrument (line of collimation) is 152.500 m and a fore sight of 2.300 m is taken on a change point, as shown. The reduced level of that point is: [2 marks]



(A) 154.800 m

(B) 152.500 m

(C) 2.300 m

(D) 150.200 m

Q43. In a Geographic Information System, a continuous surface of terrain heights stored as a regular grid of elevation values, from which slope, aspect and drainage can be derived, is called a: [2 marks]

(A) Digital Elevation Model (DEM)

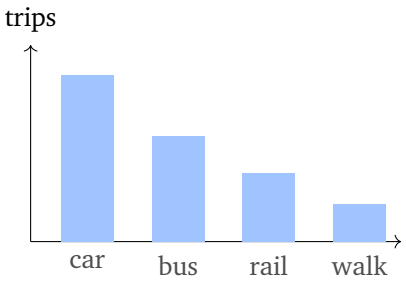
(B) topological network

(C) Thiessen polygon layer

(D) choropleth map

Infrastructure, Services and Transportation Planning

Q44. In the classical four-stage urban transportation planning process, the stage that determines the proportion of trips choosing each available travel mode (car, bus, rail, walk), as suggested by the mode shares below, is called: [2 marks]



(A) trip generation

(B) trip distribution

(C) traffic assignment

(D) modal split

Q45. In transportation planning, the "gravity model", which distributes trips between zones in proportion to their trip ends and inversely with a function of the travel cost (distance) between them, is used in which stage of the four-step process? [2 marks]

(A) trip distribution

(B) trip generation

(C) modal split

(D) traffic assignment

Q46. In traffic-engineering studies, the mixed-traffic volume on an Indian road is converted to a common standard by weighting each vehicle type against a car, using the unit called the: [2 marks]

(A) Average Daily Traffic (ADT)

(B) Vehicle-Kilometres Travelled (VKT)

(C) Annual Average Daily Traffic (AADT)

(D) Passenger Car Unit (PCU)

Detailed Solutions

Q1.

Solution

Concept – pioneers of the Modern Movement and their signature works: Each modern master is best remembered through one or two canonical buildings.

Step 1 – read the clues in the question: A house cantilevered dramatically over a natural waterfall, worked into the living rock, and described as "organic architecture".

Step 2 – match to the architect: Organic architecture, in which building and landscape are fused, is the credo of **Frank Lloyd Wright**; Fallingwater (the Kaufmann Residence) is his most famous demonstration of it.

Why the other options are wrong:

- Le Corbusier worked in the machine-age idiom of the reinforced-concrete frame, not organic architecture.
- Alvar Aalto was a Finnish master of a softer, humane modernism, but not the author of Fallingwater.
- Louis Sullivan, Wright's mentor, is known for early skyscrapers and the maxim "form follows function".

Final Answer: Frank Lloyd Wright $\Rightarrow$ A

Answer: (A) Go Back to Q1

Q2.

Solution

Concept – the minimalist strand of the Modern Movement: One line of modern architecture pursued extreme simplicity and the honest expression of structure and material.

Step 1 – read the clues: Free-standing planes of marble and onyx, slender chromed cruciform columns, reflecting pools, and the slogan "less is more".

Step 2 – match to the architect: These belong to **Mies van der Rohe**; the German Pavilion he built for the 1929 Barcelona International Exposition is the purest statement of his minimalist language.

Why the other options are wrong:

- Walter Gropius founded the Bauhaus but did not design the Barcelona Pavil-

ion.

- Philip Johnson admired and popularised Mies in America (the Glass House) but was not the Pavilion's author.
- Le Corbusier is associated with the Five Points and beton brut, a different vocabulary.

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

Answer: (C) Go Back to Q2

Q3.

Solution

Concept – the vocabulary of the Dravidian (South Indian) temple: Each part of a Hindu temple has a specific Sanskrit name.

Step 1 – read the description and figure: A tall, ornate, tapering tower that rises over the *gateway* in the enclosure wall of a South Indian temple.

Step 2 – name it: This monumental gateway tower is the **gopuram** (for example the towering gopurams of the Meenakshi temple, Madurai). It is the hallmark of mature Dravidian temple complexes.

Why the other options are wrong:

- The *shikhara* is the curvilinear spire over the sanctum in the North Indian (Nagara) style.
- The *vimana* is the pyramidal tower over the sanctum (garbhagriha) itself, not over the gateway.
- The *mandapa* is the pillared hall in front of the shrine, not a tower.

Final Answer: Gopuram $\Rightarrow$ B

Answer: (B) Go Back to Q3

Q4.

Solution

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

Step 1 – read the arrangement in the figure: The same element is repeated over and over at constant, equal spacing along a line.

Step 2 – name the principle: Regular repetition of like elements at equal in-

tervals, giving a sense of ordered movement, is **rhythm** (here a simple regular rhythm, as in a colonnade of equal columns).

Why the other options are wrong:

- Symmetry is balanced mirror-arrangement about an axis; mere repetition need not be mirrored.
- Hierarchy singles one element out as dominant; here all elements are equal.
- A datum is a continuous line, plane or volume that gathers other elements; it is not the repetition itself.

Final Answer: Rhythm $\Rightarrow$ B

Answer: (B) Go Back to Q4

Q5.

Solution

Concept – authorship of India's landmark planned city: Post-Independence India commissioned leading architects for new capitals.

Step 1 – read the clues: The planned city of Chandigarh and the raw-concrete monuments of its Capitol Complex – Assembly, High Court and Secretariat.

Step 2 – attribute: Chandigarh's master plan and its Capitol buildings are the work of **Le Corbusier** (with Pierre Jeanneret, Maxwell Fry and Jane Drew). The Open Hand monument is also his.

Why the other options are wrong:

- Louis Kahn planned the capital complex at Dhaka, not Chandigarh.
- Edwin Lutyens planned New Delhi a generation earlier, in a classical idiom.
- Otto Koenigsberger planned Bhubaneswar and advised on tropical housing, not Chandigarh's Capitol.

Final Answer: Le Corbusier $\Rightarrow$ C

Answer: (C) Go Back to Q5

Q6.

Solution

Concept – modern masters working in India: Several 20th-century giants built major Indian institutions.

Step 1 – read the clues: A campus of monumental exposed brickwork, great circular and segmental arches, and deeply shaded daylit corridors.

Step 2 – attribute: The Indian Institute of Management, Ahmedabad was designed by **Louis Kahn**, whose brick geometry and play of served/servant spaces define the campus. (B.V. Doshi was his local collaborator, but the design authorship is Kahn's.)

Why the other options are wrong:

- B.V. Doshi designed CEPT, Sangath and Aranya housing; he assisted Kahn at IIMA but was not its principal designer.
- Charles Correa designed Jawahar Kala Kendra and Kanchanjunga Apartments.
- Le Corbusier's Ahmedabad works are the Mill Owners' Association and Villa Sarabhai, not IIMA.

Final Answer: Louis Kahn $\Rightarrow$ D

Answer: (D) Go Back to Q6

Q7.

Solution

Concept – leading Indian modern architects and their ideas: Each post-Independence Indian master had a distinctive theme.

Step 1 – read the clues: "Form follows climate", the "open-to-sky space", the Kanchanjunga Apartments (Mumbai) and Jawahar Kala Kendra (Jaipur).

Step 2 – attribute: These belong to **Charles Correa**, who built a climate-responsive, courtyard-and-terrace architecture rooted in Indian tradition.

Why the other options are wrong:

- Raj Rewal is known for the Asian Games Village and the Hall of Nations, Delhi.
- Achyut Kanvinde built IIT Kanpur and the NDDB campus in a Brutalist idiom.
- B.V. Doshi is associated with CEPT, Sangath and Aranya housing.

Final Answer: Charles Correa ⇒ C

Answer: (C) Go Back to Q7

Q8.

Solution

Concept – the earliest surviving treatise on architecture: Classical theory is founded on one Roman text.

Step 1 – read the clues: The author of *De Architectura* (the "Ten Books on Architecture") and the triad *firmitas* (firmness/strength), *utilitas* (utility/commodity) and *venustas* (beauty/delight).

Step 2 – attribute: This is **Vitruvius** (Marcus Vitruvius Pollio), a Roman architect-engineer of the 1st century BCE.

Why the other options are wrong:

- Leon Battista Alberti wrote the Renaissance treatise *De Re Aedificatoria*, modelled on Vitruvius but later.
- Andrea Palladio wrote *I Quattro Libri dell'Architettura* (the Four Books) in the 16th century.
- Vignola wrote a rulebook on the five classical orders, again Renaissance and not the original triad.

Final Answer: Vitruvius ⇒ A

Answer: (A) Go Back to Q8

Q9.

Solution

Concept – field tests on fresh and hardened concrete/cement: Different tests measure different properties.

Step 1 – identify the property wanted: "Workability" (consistency) is the ease with which fresh concrete can be mixed, placed and compacted.

Step 2 – match the apparatus: The frustum-shaped mould filled, rodded and then lifted so the concrete subsides – the drop being the "slump" – is the **slump cone test**. A larger slump means a wetter, more workable mix.

Why the other options are wrong:

- The Vicat apparatus measures the setting time (and consistency) of *cement paste*, not concrete workability.
- The Le Chatelier test measures the *soundness* (unsoundness expansion) of cement.
- The Brinell test measures the hardness of metals, unrelated to concrete.

Final Answer: Slump cone test $\Rightarrow$ B

Answer: (B) Go Back to Q9

Q10.

Solution

Concept – Abrams' water-cement ratio law: The strength of fully compacted concrete depends primarily on the water-cement ratio.

Step 1 – state the law: Abrams' law: for a given set of materials and full compaction, the compressive strength is inversely related to the water-cement ratio, $f_c = \dfrac{A}{B^{w/c}}$, with A, B constants.

Step 2 – read the trend: As w/c rises, more free water leaves capillary pores on evaporation, so the hardened paste is more porous and weaker. Hence strength **decreases**.

Step 3 – note the practical limit: Too low a w/c cannot be compacted fully, which reintroduces voids – so the law assumes *full* compaction.

Why the other options are wrong:

- "Increases" is the opposite of the observed behaviour.
- Strength does not stay constant; it falls steadily with w/c.
- There is no "increase then constant" plateau within the workable range.

Final Answer: decreases $\Rightarrow$ C

Answer: (C) Go Back to Q10

Q11.

Solution

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

Step 1 – write the formula: $t_e = \dfrac{t_o + 4t_m + t_p}{6}$

Step 2 – list the data: $t_o = 4$, $t_m = 7$, $t_p = 16$.

Step 3 – compute the middle term: $4 \times t_m = 4 \times 7 = 28$

Step 4 – add the numerator: $4 + 28 + 16 = 48$

Step 5 – divide by 6**:** $t_e = \dfrac{48}{6} = 8$ days.

Why the other options are wrong:

- 9 and 6 do not follow from the weighted mean.
- 7 is the most-likely time t_m, not the expected time; the pessimistic tail pulls the mean up to 8.

Final Answer: $t_e = 8$ days $\Rightarrow$ D

Answer: (D) Go Back to Q11

Q12.

Solution

Concept – the Bogue compounds of Portland cement: Four main compounds control the setting, strength and heat of cement.

Step 1 – list the roles: C_3S (alite) hydrates fast and gives *early* strength with high heat; C_2S (belite) hydrates slowly and gives *later* strength with low heat; C_3A sets very fast (controlled by gypsum); C_4AF contributes little to strength.

Step 2 – pick the early-strength compound: Early strength and a large heat of hydration come chiefly from **tricalcium silicate, C_3S**.

Why the other options are wrong:

- C_2S gives strength at later ages and evolves little heat.
- C_4AF mainly affects colour and contributes minor strength.
- Gypsum is added only to retard the flash set of C_3A; it is not a strength-giving compound.

Final Answer: Tricalcium silicate (C_3S) $\Rightarrow$ B

Answer: (B) Go Back to Q12

Q13.

Solution

Concept – moisture and the apparent volume of sand: Fine aggregate behaves oddly in the presence of a little water.

Step 1 – describe the phenomenon: A thin film of water around each grain develops surface tension that keeps the grains apart, so a given weight of damp sand occupies a much larger loose volume than the same sand when dry or fully saturated.

Step 2 – name it: This apparent volume increase is the **bulking of sand**; it can reach 20–40% at about 4–6% moisture. It matters when concrete is batched by volume, and is allowed for by field tests.

Why the other options are wrong:

- Bleeding is the rise of water to the surface of freshly placed concrete.
- Segregation is the separation of coarse aggregate from the mix.
- Efflorescence is a white salt deposit on masonry surfaces.

Final Answer: Bulking of sand $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept – project scheduling and progress charts: Different charts display a schedule in different ways.

Step 1 – read the figure: Each activity (A, B, C, D) is drawn as a single horizontal bar; the bar's start and length are read against a horizontal time axis.

Step 2 – name it: A bar-against-time schedule is a **Gantt (bar) chart**, the simplest and most widely used tool for showing when each activity starts, runs and finishes.

Why the other options are wrong:

- A pie chart shows proportions of a whole, not a time schedule.
- A network (arrow/precedence) diagram shows logical dependencies between activities, not bars on a time scale.
- A mass-haul diagram is used in earthwork/road engineering to balance cut and fill, not to schedule activities.

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

Answer: (B) Go Back to Q14

Q15.

Solution

Concept – how plywood gains its strength: Plywood is an engineered board built from thin wood veneers.

Step 1 – describe the lay-up: Veneers (plies) are glued in a stack such that the grain of each ply is turned **at right angles** to the grain of the plies immediately above and below it (cross-graining).

Step 2 – explain the benefit: Because wood is weak across the grain, alternating the grain direction gives the board nearly equal strength in both directions, resists splitting, and greatly reduces shrinkage and warping. An *odd* number of plies is used so the two faces have parallel grain and the panel stays balanced.

Why the other options are wrong:

- Gluing all plies parallel would keep the weakness across the grain and cause warping.
- 45° or random orientation is not the standard plywood construction.

Final Answer: at right angles (perpendicular) $\Rightarrow$ C

Answer: (C) Go Back to Q15

Q16.

Solution

Concept – maximum bending moment of a simply supported beam under a UDL: For a full-span uniform load the moment is greatest at midspan.

Step 1 – write the standard result: $M_{\max} = \dfrac{wL^2}{8}$, occurring at the centre of the span.

Step 2 – list the data: $w = 5$ kN/m, span $L = 8$ m.

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

Step 4 – form the numerator: $wL^2 = 5 \times 64 = 320$

Step 5 – divide by 8: $M_{\max} = \dfrac{320}{8} = 40$ kN·m.

Why the other options are wrong:

- 80 kN·m uses $wL^2/4$, the wrong denominator.

- 20 kN·m and 10 kN·m use $wL^2/16$ or $wL^2/32$, again incorrect.

Final Answer: $M_{\max} = 40$ kN·m $\Rightarrow$ D

Answer: (D) Go Back to Q16

Q17.

Solution

Concept – shear force at the fixed end of a cantilever under a UDL: The support must carry the total downward load on the cantilever.

Step 1 – find the total load: Total UDL $= w \times L$, where $w = 4$ kN/m and $L = 3$ m.

Step 2 – substitute: $W = 4 \times 3$

Step 3 – evaluate: $W = 12$ kN.

Step 4 – relate to the support shear: For vertical equilibrium the reaction (and hence the maximum shear force, which occurs at the fixed end) equals the whole load: $V_{\max} = 12$ kN. The shear diagram falls linearly from 12 kN at the support to 0 at the free end.

Why the other options are wrong:

- 6 kN is half the load (as if only half the span were loaded).
- 18 kN and 24 kN correspond to spans of 4.5 m or 6 m, not 3 m.

Final Answer: $V_{\max} = 12$ kN $\Rightarrow$ A

Answer: (A) Go Back to Q17

Q18.

Solution

Concept – static determinacy of structures: Whether a structure can be solved by statics alone depends on counting unknowns against equations.

Step 1 – state the test: Planar statics gives three independent equilibrium equations ($\sum F_x = 0$, $\sum F_y = 0$, $\sum M = 0$). If the unknown reactions/forces number exactly three (and the structure is stable), it is determinate.

Step 2 – read the condition given: Here the unknowns *exceed* the equilibrium equations, so statics alone cannot find all the forces.

Step 3 – name the state: Such a structure is **statically indeterminate** (redun-

dant); its extra unknowns are found using compatibility (deflection) conditions in addition to equilibrium.

Why the other options are wrong:

- Unstable means too *few* or badly arranged reactions, so it forms a mechanism – the opposite case.
- Statically determinate means unknowns *equal* the equations.
- "A rigid body in free space" is not a determinacy classification.

Final Answer: statically indeterminate $\Rightarrow$ C

Answer: (C) Go Back to Q18

Q19.

Solution

Concept – failure modes of columns: Short and long columns fail in different ways.

Step 1 – distinguish by slenderness: A short, stocky column fails by direct crushing of the material. A long, slender column fails while the material is still below its crushing stress, by bowing sideways.

Step 2 – name the slender-column mode: This sudden sideways instability at a critical (Euler) load is **buckling**: $P_{cr} = \dfrac{\pi^2 EI}{(KL)^2}$, which falls rapidly as the effective length KL increases.

Why the other options are wrong:

- Direct crushing is the failure of short columns, not slender ones.
- Shear and torsion are different actions, not the axial-instability failure described.

Final Answer: buckling $\Rightarrow$ D

Answer: (D) Go Back to Q19

Q20.

Solution

Concept – reading a bending-moment diagram: The sign of the bending moment tells whether a fibre is in tension at top or bottom.

Step 1 – describe the section wanted: A point where the bending moment passes through zero and *changes sign* – so the curvature reverses from sagging (hogging) to hogging (sagging).

Step 2 – name it: This is the **point of contraflexure** (also called the point of inflexion). It occurs, for example, in continuous beams and in the spans of propped or fixed beams, and it is a useful place to curtail or splice reinforcement.

Why the other options are wrong:

- The point of maximum shear is where the shear force is greatest, unrelated to the moment sign change.
- Fixity refers to a support condition, not a section on the beam.
- Zero deflection can occur at supports and elsewhere and is not defined by the moment changing sign.

Final Answer: contraflexure (inflexion) $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q20

Q21.

Solution

Concept – bending moment at the fixed end of a cantilever with combined loads: By superposition, add the support moment caused by each load separately.

Step 1 – list the loads and the lever arm: Point load $P = 8$ kN at the free end, at a distance $L = 3$ m from the support; UDL $w = 2$ kN/m over the full length $L = 3$ m.

Step 2 – moment from the point load: $M_P = P \times L = 8 \times 3 = 24$ kN·m.

Step 3 – reduce the UDL to its resultant: Total UDL $= wL = 2 \times 3 = 6$ kN, acting at the centroid of the load, i.e. at $L/2 = 1.5$ m from the support.

Step 4 – moment from the UDL: $M_w = 6 \times 1.5 = 9$ kN·m. (Equivalently $M_w = \dfrac{wL^2}{2} = \dfrac{2 \times 3^2}{2} = 9$ kN·m.)

Step 5 – add the two contributions: $M = M_P + M_w = 24 + 9 = 33$ kN·m (hogging at the support).

Why the other options are wrong:

- 24 kN·m counts only the point load and omits the UDL.
- 30 kN·m wrongly places the UDL resultant at 1.0 m instead of 1.5 m.
- 42 kN·m wrongly places the UDL resultant at the free end (3 m).

Final Answer: $M = 33$ kN·m $\Rightarrow$ B

Answer: (B) Go Back to Q21

Q22.

Solution

Concept – India's national green-building rating system: GRIHA (Green Rating for Integrated Habitat Assessment) is the government-endorsed rating tool.

Step 1 – recall how it scores: A building is assessed against a set of criteria (site, energy, water, materials, waste, health) on a 100-*point* scale.

Step 2 – recall the rating scale: The points earned are translated into a star rating, with the top award being **5 stars** (a 1-star threshold begins around 50 points, rising to 5 stars near 90).

Why the other options are wrong:

- 3 and 4 stars are intermediate ratings, not the maximum.
- There is no 7-star level in GRIHA.

Final Answer: 5 stars $\Rightarrow$ B

Answer: (B) Go Back to Q22

Q23.

Solution

Concept – the LEED certification levels: LEED awards points that map to four named certification tiers.

Step 1 – list the tiers in order: Certified $\rightarrow$ Silver $\rightarrow$ Gold $\rightarrow$ **Platinum**, with rising point thresholds (roughly 40, 50, 60 and 80 points on the 110-point system).

Step 2 – pick the highest: The top level is **Platinum**.

Why the other options are wrong:

- Gold and Silver are intermediate levels below Platinum.

- "Diamond" is not a LEED level.

Final Answer: Platinum $\Rightarrow$ C

Answer: (C) Go Back to Q23

Q24.

Solution

Concept – adding sound levels on the decibel scale: Decibels are logarithmic, so sound levels do not add arithmetically.

Step 1 – add the intensities, not the decibels: Two equal, uncorrelated sources double the sound *intensity* (energy): $I_{\text{total}} = 2I$.

Step 2 – convert the doubling to decibels: Increase $= 10\log_{10}\left(\frac{2I}{I}\right) = 10\log_{10} 2$.

Step 3 – evaluate: $10 \times 0.301 = 3.01 \approx 3$ dB.

Step 4 – add to the original level: $60 + 3 = 63$ dB. (A doubling of equal sources always adds about 3 dB, never doubles the number.)

Why the other options are wrong:

- 120 dB wrongly adds the decibel figures arithmetically.
- 66 dB corresponds to four equal sources (+6 dB), not two.
- 60 dB ignores the second source altogether.

Final Answer: 63 dB $\Rightarrow$ D

Answer: (D) Go Back to Q24

Q25.

Solution

Concept – the sound-absorption coefficient: α measures the fraction of incident sound energy a surface absorbs (does not reflect).

Step 1 – state the range: $\alpha = 0$ for a perfect reflector (no energy absorbed) and $\alpha = 1$ for a perfect absorber (all energy absorbed, none reflected).

Step 2 – apply to an open window: Sound passing out through an open window is never reflected back into the room, so from the room's point of view all of it is "absorbed". Hence a wide open window is treated as the ideal absorber with $\alpha = \mathbf{1}$; indeed absorption is measured in units (sabins) equivalent to one square metre of open window.

Why the other options are wrong:

- $\alpha = 0$ is a perfect reflector (for example polished marble), the opposite extreme.
- $\alpha = 0.5$ is a moderate absorber, not the ideal.
- α cannot exceed 1 (by its definition as a fraction), so 100 is meaningless.

Final Answer: $\alpha = 1 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q25

Q26.

Solution

Concept – the mass law of airborne sound insulation: The transmission loss of a single panel is governed mainly by its weight.

Step 1 – state the mass law: For a single, limp, homogeneous partition, the sound transmission loss rises by about 6 dB for every doubling of the *surface mass* (mass per unit area) or of the frequency.

Step 2 – identify the controlling property: Therefore the way to raise a wall's airborne sound insulation is to make it **heavier per unit area** – a thicker or denser wall. This is why solid masonry insulates better than a light partition.

Why the other options are wrong:

- Surface area does not enter the mass law (transmission loss is per unit area).
- Increasing porosity helps sound *absorption*, not transmission loss; a porous wall lets sound through.
- Stiffness governs coincidence-dip behaviour, not the basic mass-law trend; very stiff panels can actually worsen insulation near the coincidence frequency.

Final Answer: surface mass (weight per unit area) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q26

Q27.

Solution

Concept – the administrator of the IGBC rating system: India has more than one green-rating body; each is run by a different organisation.

Step 1 – recall IGBC: The Indian Green Building Council (IGBC) was set up in 2001 as a part of the **Confederation of Indian Industry (CII)**, and it runs the IGBC family of rating systems (IGBC Green New Buildings, Green Homes, Green Factory, and so on).

Step 2 – separate it from GRIHA: GRIHA is run by TERI with the MNRE; IGBC is run by CII. Both operate in India but under different bodies.

Why the other options are wrong:

- The Bureau of Indian Standards issues IS codes, not the IGBC rating.
- The Ministry of Housing and Urban Affairs frames urban policy but does not administer IGBC.
- The NBCC is a construction PSU, not the IGBC's parent body.

Final Answer: Confederation of Indian Industry (CII) $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q27

Q28.

Solution

Concept – how an acoustic barrier attenuates noise: A barrier works by forcing the sound to diffract over its top edge, casting a "sound shadow".

Step 1 – link attenuation to path difference and wavelength: The screening is measured by the Fresnel number $N = \dfrac{2\delta}{\lambda}$, where δ is the extra path length over the barrier and λ the wavelength. Attenuation rises as N rises.

Step 2 – see the effect of frequency: High-frequency sound has a short wavelength λ, so for the same path difference δ the Fresnel number N is large – strong attenuation. Low-frequency sound has a long wavelength, gives a small N, and bends (diffracts) easily around the barrier.

Step 3 – conclude: Barriers are therefore effective mainly against **high-frequency (short-wavelength)** noise, and much less so against low-frequency rumble.

Why the other options are wrong:

- Low-frequency sound diffracts around the barrier and is poorly screened.

- Infrasound (very low frequency) is screened least of all.
- The screening is strongly frequency-dependent, so "all equally" is false.

Final Answer: high-frequency (short-wavelength) sound $\Rightarrow$ A

Answer: (A) Go Back to Q28

Q29.

Solution

Concept – the founders of landscape architecture: The modern profession has a clear point of origin in 19th-century America.

Step 1 – read the clues: The designer of New York's Central Park, who is credited with establishing "landscape architecture" as a named profession.

Step 2 – attribute: This is **Frederick Law Olmsted**, who with Calvert Vaux won the Central Park competition (Greensward plan) and later designed park systems, campuses and suburbs across the United States.

Why the other options are wrong:

- "Capability" Brown created the naturalistic English landscape garden a century earlier.
- André Le Nôtre designed the formal French gardens of Versailles.
- Ian McHarg was a 20th-century ecological planner (*Design with Nature*), not the designer of Central Park.

Final Answer: Frederick Law Olmsted $\Rightarrow$ C

Answer: (C) Go Back to Q29

Q30.

Solution

Concept – ecological method in landscape planning: Site suitability can be assessed by combining thematic maps.

Step 1 – describe the technique: Separate transparent maps of slope, soils, geology, drainage, vegetation, wildlife and scenic value are prepared, shaded darker where development is less suitable, and then *overlaid*. Where the stack is lightest, the land is most suitable; where darkest, it should be protected.

Step 2 – attribute: This overlay (or "sieve") mapping method was set out by **Ian McHarg** in *Design with Nature* (1969), and it is the conceptual ancestor of GIS

overlay analysis.

Why the other options are wrong:

- Kevin Lynch studied the perceptual image of the city, not ecological overlays.
- Gordon Cullen developed townscape and serial vision.
- Christopher Alexander wrote *A Pattern Language*, a different design method.

Final Answer: Ian McHarg ⇒ A

Answer: (A) Go Back to Q30

Q31.

Solution

Concept – Kevin Lynch and the perception of the city: Lynch judged cities by how clearly people can read and remember them.

Step 1 – define the quality: Imageability (also called legibility) is the quality in a physical object – here a city – that gives it a high probability of evoking a strong, vivid, well-structured mental image in any observer.

Step 2 – link to his five elements: A highly imageable city has clear paths, edges, districts, nodes and landmarks, so its parts organise readily into a coherent whole.

Why the other options are wrong:

- Permeability is the degree to which an area offers choice of routes (a Responsive Environments term), not Lynch's image quality.
- Enclosure describes how a space is bounded by its edges.
- Transparency refers to seeing through or reading layers of space, not the mental-image quality.

Final Answer: imageability (legibility) ⇒ B

Answer: (B) Go Back to Q31

Q32.

Solution

Concept – the historic styles of garden design: Garden traditions divide broadly into the formal (geometric) and the informal (naturalistic).

Step 1 – read the clues: Strictly geometric, axial layout with clipped parterres, long straight allees and grand water axes; the gardens of Versailles.

Step 2 – attribute: This French formal (jardin à la française) style was perfected by **André Le Nôtre**, gardener to Louis XIV, who laid out Versailles and Vaux-le-Vicomte.

Why the other options are wrong:

- "Capability" Brown and Humphry Repton created the *informal*, naturalistic English landscape garden, the antithesis of the formal axis.
- Frederick Law Olmsted worked in the naturalistic tradition (Central Park), not the French formal style.

Final Answer: André Le Nôtre $\Rightarrow$ A

Answer: (A) Go Back to Q32

Q33.

Solution

Concept – responding to topography in site planning: Good site planning treats the natural land form as an asset, not an obstacle.

Step 1 – read the site: The contours show gently sloping ground rising from 100 m to 102 m.

Step 2 – choose the response: The most economical and least damaging approach is to **grade the site to follow the existing land form, balancing cut and fill** – setting the building along the contours (or stepping it down the slope) so that the earth excavated in one place fills another, keeping earthwork, retaining structures and drainage disturbance to a minimum.

Step 3 – note the benefits: This conserves topsoil and vegetation, avoids costly imported fill or off-site disposal, respects natural drainage, and preserves the character of the land.

Why the other options are wrong:

- Levelling the whole site flat demands heavy, wasteful cut and fill and destroys the natural drainage.
- Disregarding the topography leads to drainage and erosion problems and higher cost.
- Ringing the site with tall retaining walls is expensive and is a last resort, not the primary strategy.

Final Answer: grade the site to follow the land form, balancing cut and fill $\Rightarrow$ A

Answer: (A) Go Back to Q33

Q34.

Solution

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

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

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

Step 3 – substitute: $\text{Density} = \dfrac{12000}{40}$

Step 4 – evaluate: Density $= 300$ persons/ha.

Why the other options are wrong:

- 200 persons/ha would need 60 ha for the same population.
- 480 persons/ha would need only 25 ha.
- 250 persons/ha does not follow from $12000/40$.

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

Answer: (C) Go Back to Q34

Q35.

Solution

Concept – Floor Area Ratio (FAR / FSI): FAR is the ratio of total built-up floor area to plot area: $\text{FAR} = \dfrac{\text{total floor area}}{\text{plot area}}$.

Step 1 – rearrange for the floor area: Total floor area $=$ FAR $\times$ plot area.

Step 2 – list the data: Plot area $= 800$ m^2; FAR $= 2.0$.

Step 3 – substitute: Total floor area $= 2.0 \times 800$

Step 4 – evaluate: Total floor area $= 1600$ m^2.

Step 5 – interpret: The 1600 m^2 is the sum over all floors within the setback envelope; for example four floors of 400 m^2 each, or two floors of 800 m^2, all capped at this total.

Why the other options are wrong:

- 400 m^2 divides by FAR instead of multiplying.
- 800 m^2 is the plot area (as if FAR $= 1$).

- 2400 m^2 uses FAR $= 3.0$.

Final Answer: 1600 $m^2 \Rightarrow$ C

Answer: (C) Go Back to Q35

Q36.

Solution

Concept – the Radburn idea in neighbourhood planning: Radburn (New Jersey, 1929) pioneered the separation of people from cars.

Step 1 – recall the layout: Large super-blocks; a hierarchy of specialised roads with cul-de-sacs serving the houses; dwellings turned *inward* to face continuous interior parks; and pedestrian paths crossing the roads by underpasses or bridges, so foot and vehicle traffic never conflict.

Step 2 – attribute: Radburn was designed by **Clarence Stein and Henry Wright** (for the City Housing Corporation).

Why the other options are wrong:

- Ebenezer Howard conceived the Garden City, a whole-town idea.
- Clarence Perry framed the Neighbourhood Unit, a related but distinct concept.
- Le Corbusier proposed the high-rise Radiant City, not the low-rise Radburn superblock.

Final Answer: Henry Wright $\Rightarrow$ D

Answer: (D) Go Back to Q36

Q37.

Solution

Concept – classical models of urban land-use structure: Three famous models describe how land uses arrange themselves in a city.

Step 1 – read the figure: A single Central Business District at the centre, ringed by successive concentric zones (transition, workers' homes, better residences, commuters).

Step 2 – attribute: This is the **Concentric Zone model** of **Ernest Burgess** (1925), developed for Chicago within the human-ecology school.

Why the other options are wrong:

- Homer Hoyt's Sector model arranges uses in wedges radiating from the centre along transport lines, not rings.
- Harris and Ullman's Multiple Nuclei model has several separate centres, not one.
- Walter Christaller's Central Place Theory concerns settlement spacing across a region, not internal city zones.

Final Answer: Ernest Burgess $\Rightarrow$ C

Answer: (C) Go Back to Q37

Q38.

Solution

Concept – regional theory of settlement spacing: One theory explains why towns of different sizes are spaced as they are.

Step 1 – read the figure: Settlements sit at the centres of nested *hexagonal* market (service) areas, with larger centres offering higher-order goods over wider areas.

Step 2 – name it: This is **Central Place Theory**, put forward by **Walter Christaller** (1933), which uses the hexagon as the most efficient space-filling shape for overlapping market areas and defines a hierarchy of central places.

Why the other options are wrong:

- The Concentric Zone and Sector theories describe land use *within* a single city, not a regional network of towns.
- The Multiple Nuclei theory also addresses internal city structure, not hexagonal market areas.

Final Answer: Central Place Theory (Christaller) $\Rightarrow$ A

Answer: (A) Go Back to Q38

Q39.

Solution

Concept – approaches to providing affordable housing: Housing programmes differ in how much the state builds versus enables.

Step 1 – describe the approach: The authority lays out plots and provides the

basic services – an access road, water supply, drainage and sanitation, sometimes a core toilet or a single room – and then hands the serviced plot to the beneficiary.

Step 2 – name it: The occupant builds and extends the house incrementally by self-help over time. This "enabling" approach is the **site-and-services scheme**, promoted for low-income housing (for example the Aranya scheme, Indore).

Why the other options are wrong:

- In turnkey housing the authority builds the complete finished house and hands over the keys.
- Rental housing lets built units to tenants; the occupant does not build.
- In cooperative group housing a members' society develops the completed dwellings collectively.

Final Answer: site-and-services scheme $\Rightarrow$ D

Answer: (D) Go Back to Q39

Q40.

Solution

Concept – what a total station is: The total station replaced the separate theodolite and tape/chain on modern surveys.

Step 1 – list its parts: A total station combines an *electronic (digital) theodolite*, which measures horizontal and vertical *angles*, with an **electronic distance meter (EDM)**, which measures *distances* by timing a modulated infrared or laser beam reflected from a prism or surface.

Step 2 – note the output: With angle and distance measured together, and an onboard microprocessor, the instrument computes coordinates (E, N, RL) of each point directly and stores them.

Why the other options are wrong:

- A GPS receiver is a separate positioning technology; it is not the component that pairs with the theodolite in a total station (a GNSS-enabled unit is a further add-on).
- A spirit level tube alone only levels the instrument; it does not measure distance.
- A plane table and alidade belong to a different, graphical surveying method.

Final Answer: electronic distance meter (EDM) $\Rightarrow$ B

Answer: (B) Go Back to Q40

Q41.

Solution

Concept – satellites needed for a GNSS position fix: GNSS positioning solves for the receiver's location plus a clock error.

Step 1 – count the unknowns: The receiver must find four unknowns: three position coordinates (X, Y, Z or latitude, longitude, height) *and* its own clock bias Δt, because a cheap receiver clock is not perfectly synchronised with the satellite clocks.

Step 2 – match satellites to unknowns: Each satellite gives one pseudo-range equation. Four unknowns need at least **four** independent equations, hence **four satellites** observed simultaneously.

Step 3 – note the special case: Only three would suffice if the receiver clock were perfect (or if height were known, reducing the unknowns) – but in normal 3-D positioning the clock bias makes four the minimum.

Why the other options are wrong:

- 2 or 3 satellites are too few to solve for position plus clock error.
- 6 satellites improve accuracy and geometry (lower dilution of precision) but are more than the *minimum* needed.

Final Answer: 4 satellites $\Rightarrow$ B

Answer: (B) Go Back to Q41

Q42.

Solution

Concept – reduced level by the height-of-instrument method: The reduced level of a point is the line of collimation minus the staff reading on that point.

Step 1 – write the relation: RL of point $=$ HI $-$ fore sight (FS)

Step 2 – list the data: HI $= 152.500$ m; FS $= 2.300$ m.

Step 3 – substitute: RL $= 152.500 - 2.300$

Step 4 – evaluate: RL $= 150.200$ m.

Step 5 – interpret: The fore sight is *subtracted* because a larger staff reading means the point is lower below the fixed line of sight.

Why the other options are wrong:

- 154.800 m *adds* the fore sight, which is the operation for a back sight, not a fore sight.
- 152.500 m ignores the fore sight entirely.
- 2.300 m is just the staff reading, not a reduced level.

Final Answer: RL = 150.200 m ⇒ D

Answer: (D) Go Back to Q42

Q43.

Solution

Concept – representing terrain in a GIS: Elevation is stored as a special raster surface.

Step 1 – describe the data: A continuous surface of ground heights, held as a regular grid in which every cell carries an elevation value.

Step 2 – name it: This is a **Digital Elevation Model (DEM)**. From it a GIS derives slope, aspect, hill-shade, watersheds and drainage networks, and it underlies contour generation and cut-and-fill analysis.

Why the other options are wrong:

- A topological network stores connectivity of line features (roads, pipes), not a height surface.
- Thiessen (Voronoi) polygons partition space around points, not a terrain surface.
- A choropleth map shades areas by an attribute value; it is a thematic display, not an elevation grid.

Final Answer: Digital Elevation Model (DEM) ⇒ A

Answer: (A) Go Back to Q43

Q44.

Solution

Concept – the four-stage urban transport model: The sequence is trip generation → trip distribution → modal split → traffic assignment.

Step 1 – identify the stage from the clue: The bar chart shows how the total

trips *split among modes* (car, bus, rail, walk).

Step 2 – name it: Dividing trips among the competing modes is the **modal split** stage. It answers "by which mode?" and depends on travel time, cost, comfort and car ownership.

Why the other options are wrong:

- Trip generation counts *how many* trips each zone produces and attracts.
- Trip distribution links origins to destinations ("from where to where").
- Traffic assignment loads the trips onto specific routes of the network.

Final Answer: modal split $\Rightarrow$ D

Answer: (D) Go Back to Q44

Q45.

Solution

Concept – the gravity model in transport planning: Certain mathematical models belong to specific stages of the four-step process.

Step 1 – state the model: By analogy with Newton's law of gravitation, the number of trips between two zones is taken as directly proportional to the product of their trip ends (attractiveness) and inversely proportional to a function of the travel cost or distance between them: $T_{ij} \propto \dfrac{P_i A_j}{f(c_{ij})}$.

Step 2 – match to the stage: Pairing origins with destinations – deciding how the trips generated in each zone spread to the other zones – is the **trip distribution** stage, and the gravity model is its standard tool.

Why the other options are wrong:

- Trip generation only estimates the totals per zone; it uses regression or category analysis, not the gravity model.
- Modal split allocates trips among modes.
- Traffic assignment routes trips onto network links (using shortest-path or equilibrium methods).

Final Answer: trip distribution $\Rightarrow$ A

Answer: (A) Go Back to Q45

Q46.

Solution

Concept – expressing mixed traffic in a common unit: Indian roads carry very different vehicles, so volumes are standardised.

Step 1 – state the need: A truck, a car, a two-wheeler and a cycle occupy different road space and move at different speeds, so simply counting "vehicles" is misleading.

Step 2 – name the unit: Each vehicle type is converted to an equivalent number of standard cars using an equivalency factor, giving the **Passenger Car Unit (PCU)**. For example (IRC values) a car $= 1$, a two-wheeler ≈ 0.5, and a truck/bus ≈ 3 PCU. Road capacity and volume are then expressed in PCU per hour.

Why the other options are wrong:

- ADT and AADT are simply average daily traffic counts, not an equivalency unit.
- VKT (vehicle-kilometres travelled) measures total travel, not a per-vehicle car-equivalent.

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

Answer: (D) Go Back to Q46

Answer Key

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