GATE Architecture and Planning

Sample Paper – 2

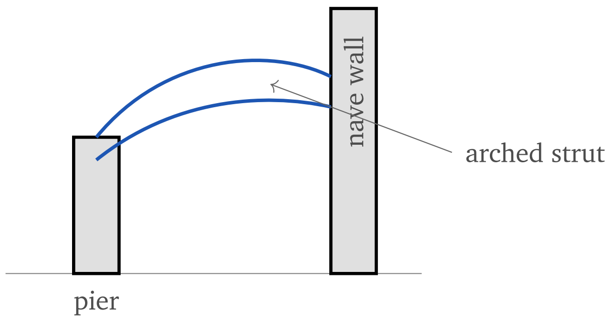
Duration: 128 Minutes **Maximum Marks: 72**

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 Gothic structural device shown – an arched masonry strut that carries the outward thrust of a high nave vault across the aisle roof to a detached external pier – is called a: **[1 mark]**



(A) Flying buttress

(B) Pendentive

(C) Squinch

(D) Corbel

Q2. In North Indian (Nagara) temple architecture, the curvilinear, beehive-shaped tower that rises directly above the sanctum (garbhagriha) is called the: **[1 mark]**

(A) Shikhara

(B) Gopuram

(C) Vimana

(D) Mandapa

Q3. In the entablature of the classical Greek Doric order shown, the frieze is made up of an alternating arrangement of vertically grooved blocks and the near-square panels between them. These two elements are called, respectively: **[1 mark]**

(A) Architrave and cornice

(B) Volutes and abacus

(C) Mutules and guttae

(D) Triglyphs and metopes

Q4. The large, circular, radiating stained-glass window set high in the west facade of a Gothic cathedral (as at Notre-Dame de Paris) is known as a: **[1 mark]**

(A) Clerestory window

(B) Rose window

(C) Oriel window

(D) Lancet window

Q5. The Kailasa temple at Ellora, the largest monolithic rock-cut temple in the world, carved downward from a single basalt outcrop, was executed in the 8th century under the patronage of which dynasty? **[1 mark]**

(A) Chola

(B) Chandela

(C) Pallava

(D) Rashtrakuta

Q6. A Roman architectural order that combines the spiral volutes of the Ionic capital with the acanthus foliage of the Corinthian capital is the: **[1 mark]**

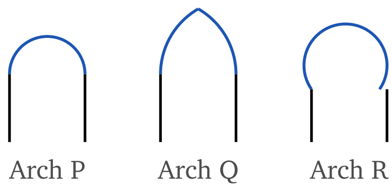
(A) Composite order

(B) Tuscan order

(C) Doric order

(D) Aeolic order

Q7. Among the three arch profiles shown, the one whose two-centred, upward-meeting form directs loads more steeply downward and became the structural signature of Gothic architecture is: **[1 mark]**



(A) The semicircular arch (Arch P)

(B) The pointed arch (Arch Q)

(C) The horseshoe arch (Arch R)

(D) The segmental arch

Q8. The ancient Roman architect and engineer who, in his treatise *De architectura*, held that good building must display *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. A traditional carpentry joint in which the shaped end (tongue) of one timber member is inserted into a matching rectangular hole cut in the other member is called a: **[1 mark]**

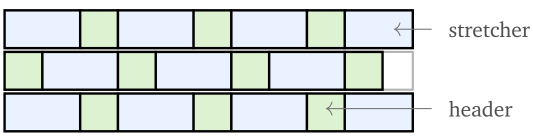
(A) Dovetail joint

(B) Scarf joint

(C) Mortise-and-tenon joint

(D) Butt joint

Q10. The brick bond shown, in which every course carries alternate headers and stretchers with each header centred over the stretcher below, giving a strong bond and an attractive face, is the: **[1 mark]**



(A) Stretcher bond

(B) Header bond

(C) English bond

(D) Flemish bond

Q11. In the PERT technique, the expected duration t_e of an activity is estimated from its optimistic time t_o, most likely time t_m and pessimistic time t_p by the weighted formula: **[1 mark]**

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

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

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

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

Q12. For an activity, the optimistic time is 4 days, the most likely time is 7 days and the pessimistic time is 16 days. Using the PERT weighting, the expected duration of the activity is: **[1 mark]**

(A) 7 days

(B) 8 days

(C) 9 days

(D) 10 days

Q13. In PERT, the variance of an activity's duration, expressed in terms of the optimistic time t_o and pessimistic time t_p, is given by: **[1 mark]**

(A) $\dfrac{t_p - t_o}{6}$

(B) $\left(\dfrac{t_p - t_o}{3}\right)^2$

(C) $\left(\dfrac{t_p - t_o}{6}\right)^2$

(D) $\dfrac{t_p + t_o}{6}$

Q14. In traditional lime mortar for masonry, the addition of a pozzolanic material such as *surkhi* (finely ground burnt-clay/brick powder) is done chiefly to: **[1 mark]**

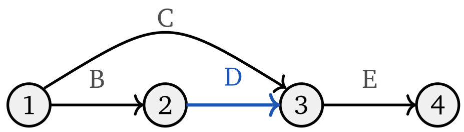
(A) give a red colour to the mortar

(B) act only as an inert filler to reduce cost

(C) impart hydraulic properties so the mortar can set and gain strength in damp conditions

(D) increase its final setting time

Q15. In the activity-on-arrow network shown, activity D has an earliest start of 8 days and takes 4 days, so its earliest finish is 12 days; its latest finish is 17 days. The total float of activity D is: **[1 mark]**



D: ES = 8, EF = 12, LF = 17

(A) 4 days

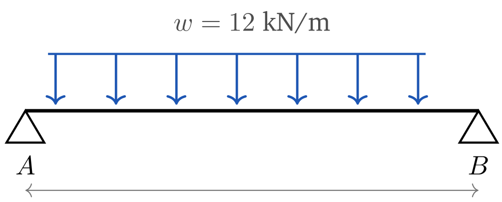
(B) 5 days

(C) 9 days

(D) 3 days

Building Structures and Systems

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



(A) 48 kN·m

(B) 24 kN·m

(C) 96 kN·m

(D) 12 kN·m

Q17. In a triangulated roof truss, a member that carries pure axial compression and a member that carries pure axial tension are respectively termed a: **[1 mark]**

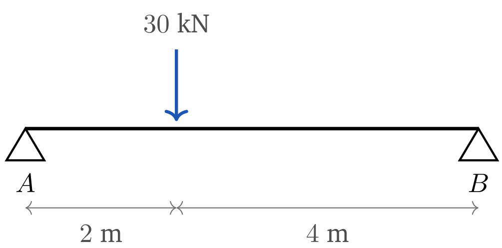
(A) Tie and strut

(B) Beam and column

(C) Purlin and rafter

(D) Strut and tie

Q18. A simply supported beam AB of span 6 m carries a single point load of 30 kN placed 2 m from support A, as shown. The vertical reaction at support A is: **[1 mark]**



(A) 10 kN

(B) 15 kN

(C) 20 kN

(D) 30 kN

Q19. The type of stress that tends to make one part of a body slide past the adjacent part along the plane of a cut, produced by two equal and opposite transverse (parallel) forces, is: **[1 mark]**

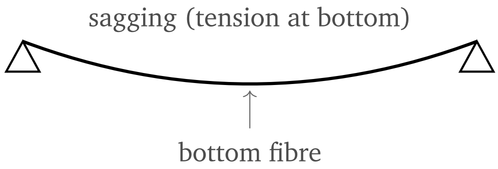
(A) Tensile stress

(B) Compressive stress

(C) Bearing stress

(D) Shear stress

Q20. In a reinforced-concrete beam subjected to sagging (positive) bending, as sketched, the main longitudinal tensile reinforcement must be provided: **[1 mark]**



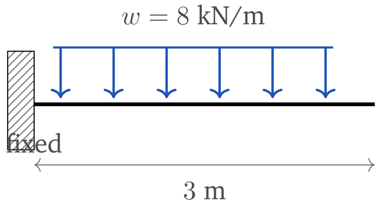
(A) near the bottom face, where the tension develops

(B) near the top face

(C) exactly at the neutral axis

(D) uniformly over the full depth

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



(A) 36 kN·m

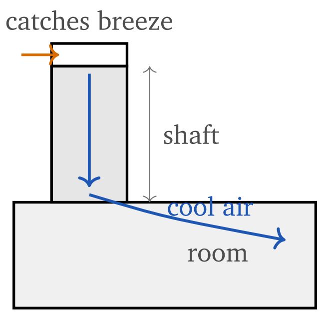
(B) 12 kN·m

(C) 24 kN·m

(D) 72 kN·m

Environmental Design and Building Services

Q22. The traditional passive-cooling element shown in section – a tall shaft rising above the roof that catches breeze at high level and channels cooler air down into the rooms below, widely used in hot-dry Rajasthan and the Middle East – is called a: **[2 marks]**



(A) Trombe wall

(B) Wind tower (badgir)

(C) Brise-soleil

(D) Light shelf

Q23. In a hot-dry climate, the traditional central courtyard house cools itself at night chiefly because: [2 marks]

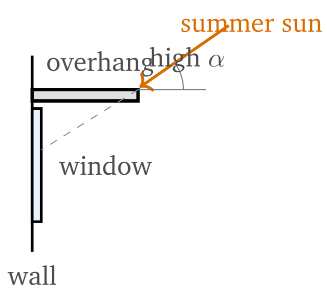
(A) the courtyard admits the midday summer sun deep into all the rooms

(B) the courtyard increases the thickness of the external walls

(C) at night the courtyard surfaces radiate their stored heat to the cold, clear night sky, and cooler dense air settles down into the court

(D) it always keeps the indoor humidity very high through a fountain alone

Q24. A horizontal projection (chhajja / overhang) over a south-facing window in the northern hemisphere is an effective shading device chiefly because, at midday in summer, the sun on the south facade is: [2 marks]



(A) low in the sky and coming only from the east

(B) low in the sky and coming only from the west

(C) high in altitude at midday, so a horizontal overhang casts its shadow down over the glass

(D) completely absent from the sky in summer

Q25. A wall has a thermal transmittance (U-value) of 2.5 W/m^{2}K. For a wall area of 10 m^2 and a steady inside-to-outside air-temperature difference of $20°$C, the rate of heat flow through the wall is: **[2 marks]**

(A) 250 W

(B) 500 W

(C) 50 W

(D) 1000 W

Q26. A south-facing masonry wall, painted dark on its outer face and enclosed a short distance in front by a glass pane, which absorbs solar radiation through the glass and then releases the stored heat slowly to the room behind, is called a: **[2 marks]**

(A) cavity wall

(B) shear wall

(C) parapet wall

(D) Trombe wall

Q27. The "stack effect" that drives natural ventilation through a tall internal space (such as a courtyard or an atrium) arises because: **[2 marks]**

(A) warm indoor air is less dense and rises, escaping through high openings while cooler, denser air is drawn in through low openings

(B) wind pressure on the windward wall is the only cause of the air movement

(C) mechanical fans are always needed to force the air upward

(D) solar radiation falling on the roof alone pushes the air downward

Q28. The daylight factor at a point indoors is the ratio of the indoor illuminance at that point to the simultaneous outdoor illuminance from an unobstructed sky, expressed as a percentage. If the indoor illuminance is 300 lux and the outdoor illuminance is 15000 lux, the daylight factor is: **[2 marks]**

(A) 5%

(B) 20%

(C) 2%

(D) 0.5%

Urban Design and Landscape Architecture

Q29. The 18th-century English landscape-garden device consisting of a sunken ditch (with a retaining wall on one side) that keeps grazing animals out while preserving an uninterrupted view from the garden across the countryside is called a: **[2 marks]**

(A) Ha-ha

(B) Pergola

(C) Parterre

(D) Topiary

Q30. Kevin Lynch described the ease with which the parts of a city can be recognised and organised into a coherent mental pattern. A layout of clearly named streets, distinct districts and visible landmarks primarily improves a city's: **[2 marks]**

(A) gross density

(B) floor area ratio

(C) legibility (imageability)

(D) ground coverage

Q31. The formal garden layout of symmetrical planting beds outlined by low clipped hedges to form ornamental patterns, best seen in the gardens of Versailles, is called a: [2 marks]

(A) arboretum

(B) parterre

(C) wilderness grove

(D) allotment

Q32. In his book *City Planning According to Artistic Principles*, Camillo Sitte advocated the design of irregular, enclosed public squares modelled on the medieval European town, in direct reaction against: [2 marks]

(A) the Garden City movement

(B) the Neighbourhood Unit concept

(C) the medieval town itself

(D) the rigid, monotonous gridiron layouts of 19th-century planning

Q33. A linear open-space corridor – often laid along a river bank, a ridge line or a disused railway – that links parks and natural areas together for recreation and for wildlife movement is called a: [2 marks]

(A) cul-de-sac

(B) greenway

(C) building setback

(D) easement

Urban and Regional Planning and Housing

Q34. In Ebenezer Howard's "Three Magnets" diagram, the magnets "Town", "Country" and "Town-Country" were used to argue that the ideal Garden City should: [2 marks]

(A) combine the advantages of both town and country while avoiding their drawbacks

(B) maximise industrial density at the very centre of the town

(C) abolish all agriculture from the region around the town

(D) concentrate the whole population into high-rise blocks

Q35. Howard proposed that each Garden City be limited in size and that, once it reached its target population of about 32,000 persons, further growth should be accommodated by: **[2 marks]**

(A) founding a new Garden City nearby, so the settlements form a polycentric cluster ("Social City")

(B) demolishing the surrounding greenbelt to spread outward

(C) building ever taller tower blocks in the town centre

(D) merging the town with the nearest large industrial city

Q36. The first Garden City actually built to realise Howard's ideas, begun in 1903 and master-planned by Raymond Unwin and Barry Parker, was: **[2 marks]**

(A) Welwyn Garden City

(B) Letchworth

(C) Radburn

(D) Milton Keynes

Q37. A housing programme in which a public agency lays out serviced plots with basic infrastructure (water supply, drainage and a sanitary core) and the allottee then builds the dwelling incrementally with their own resources is known as a: **[2 marks]**

(A) turnkey construction contract

(B) sites-and-services scheme

(C) transferable development right

(D) gated community scheme

Q38. A residential neighbourhood is planned for a population of 8000 persons at an average household size of 5 persons per dwelling. The number of dwelling units required is: **[2 marks]**

(A) 800

(B) 1000

(C) 1600

(D) 4000

Q39. The "Radburn layout", developed by Clarence Stein and Henry Wright in New Jersey (1929), is best known for introducing: **[2 marks]**

(A) the superblock with complete separation of pedestrian and vehicular movement, houses turned inward to green spaces and served by cul-de-sacs

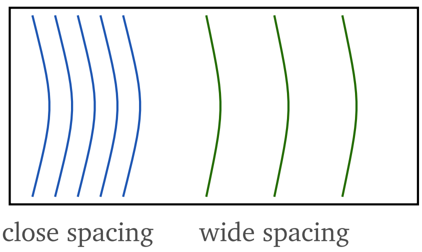
(B) the high-rise residential tower set in a park

(C) the linear ribbon town strung along a single highway

(D) the radial-concentric "ideal city" plan

Planning Techniques, Surveying and GIS

Q40. On the topographic map shown, the lines join points of equal ground elevation. Where such contour lines are spaced very close together (as on the left), the ground is: **[2 marks]**



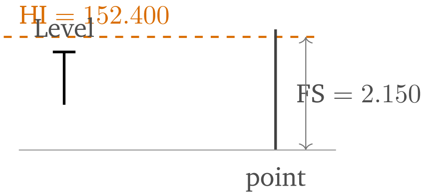
(A) steep

(B) flat or only gently sloping

(C) below sea level

(D) necessarily a water body

Q41. In differential levelling by the height-of-instrument method, the height of the instrument (line of collimation) is 152.400 m and a fore sight of 2.150 m is taken on a change point, as shown. The reduced level of that point is: **[2 marks]**



(A) 154.550 m

(B) 152.400 m

(C) 2.150 m

(D) 150.250 m

Q42. Two points on a survey map are 40 m apart in plan and lie on adjacent contours that differ by 2 m in elevation. The gradient (ground slope) between them is: **[2 marks]**

(A) 1 in 5

(B) 1 in 10

(C) 1 in 40

(D) 1 in 20

Q43. The land-surveying instrument used to measure both horizontal and vertical angles precisely – and whose modern electronic form, coupled with a distance meter, is the "total station" – is the: **[2 marks]**

(A) plane table

(B) theodolite

(C) dumpy level

(D) prismatic compass

Infrastructure, Services and Transportation Planning

Q44. In a municipal sewerage scheme designed on the "separate system", the sanitary sewage and the storm (rain) water are: **[2 marks]**

(A) carried together in one single combined pipe

(B) carried in two entirely separate pipe networks

(C) both discharged untreated into the nearest river

(D) stored together in a single common septic tank

Q45. On a single traffic lane, vehicles pass a point at an average time headway (gap between successive vehicles) of 3 seconds. The traffic flow (volume) on that lane is: **[2 marks]**

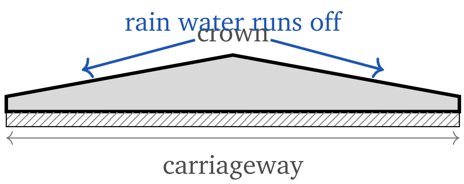
(A) 300 vehicles per hour

(B) 600 vehicles per hour

(C) 900 vehicles per hour

(D) 1200 vehicles per hour

Q46. In the road cross-section shown, the carriageway is given a slight transverse slope falling from the crown at the centre to the edges. This "camber" is provided chiefly to: **[2 marks]**



(A) increase the design speed of the road

(B) provide the super-elevation needed on sharp curves

(C) drain rain water quickly off the carriageway surface

(D) reduce the cost of road construction

Detailed Solutions

Q1.

Solution

Concept – resolving the thrust of a Gothic vault: A tall stone vault pushes not only downward but strongly *outward* at its springing, and this outward thrust has to be carried safely to the ground.

Step 1 – read what the device does: An arched masonry strut springs from the high nave wall, leaps across the lower aisle roof, and lands on a heavy detached external pier (often capped by a pinnacle).

Step 2 – name it: This half-arch carrying thrust "through the air" is the **flying buttress**. It let Gothic builders open the walls up for large windows because the walls no longer had to be thick to resist the thrust themselves.

Why the other options are wrong:

- A pendentive is a curved triangular surface that carries a dome over a square bay.
- A squinch is a small arch or lintel bridging the corner of a square to seat a dome.
- A corbel is a short bracket projecting from a wall to carry a load just above it, not a spanning strut.

Final Answer: Flying buttress $\Rightarrow \boxed{\text{A}}$

$\boxed{\text{Answer: (A)}}$ Go Back to Q1

Q2.

Solution

Concept – the parts of a North Indian (Nagara) temple: The Nagara temple is read from its silhouette, dominated by the tower over the shrine.

Step 1 – locate the tower: Directly above the garbhagriha (the small dark sanctum housing the deity) rises a tall, curvilinear, beehive-shaped tower.

Step 2 – name it: In the Nagara style this tower is the **shikhara**, usually crowned by a ribbed disc (amalaka) and a finial (kalasha).

Why the other options are wrong:

- The gopuram is the tall gateway tower of a South Indian (Dravidian) temple, over the enclosure entrance, not the shrine.

- The vimana is the South Indian pyramidal tower over the sanctum, the Dravidian counterpart, not the Nagara term asked for.
- The mandapa is the pillared hall in front of the sanctum, not a tower.

Final Answer: Shikhara $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q2

Q3.

Solution

Concept – the entablature of the Doric order: The entablature (the horizontal band carried on the columns) has three parts: architrave, frieze and cornice.

Step 1 – look at the frieze: The Doric frieze is the middle band. It is made of an alternating rhythm of two elements.

Step 2 – name the grooved block (X): The projecting block with vertical channels (usually two full grooves and two half grooves) is the **triglyph**.

Step 3 – name the panel (Y): The near-square space between two triglyphs, often carrying sculpture, is the **metope**.

Why the other options are wrong:

- Architrave and cornice are the lowest and topmost bands of the entablature, not the two parts of the frieze.
- Volutes and abacus belong to the Ionic capital, not the frieze.
- Mutules and guttae are small drip-blocks and peg-like ornaments under the cornice, not the frieze pair asked for.

Final Answer: Triglyphs and metopes $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q3

Q4.

Solution

Concept – Gothic window types: Gothic churches are famous for large windows filled with tracery and coloured glass.

Step 1 – read the description: A large, *circular* window with stone tracery radiating like the spokes of a wheel, set high in the main facade.

Step 2 – name it: This is the **rose window** (wheel window), a hallmark of the great Gothic cathedral fronts such as Notre-Dame de Paris.

Why the other options are wrong:

- A clerestory window is an upper row of windows along the nave wall that lets daylight in above the aisle roofs; it is not the round facade window.
- An oriel window is a bay window that projects from an upper floor on brackets.
- A lancet is a tall, narrow, pointed window, often grouped, but not circular.

Final Answer: Rose window $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q4

Q5.

Solution

Concept – dating and patronage of Indian rock-cut architecture: Major rock-cut monuments are linked to the dynasties that commissioned them.

Step 1 – identify the monument: The Kailasa temple (Cave 16) at Ellora is a full Dravidian-style temple carved top-down out of a single basalt hillside, complete with tower, gateway and courtyard.

Step 2 – recall the patron: It was commissioned in the 8th century by the **Rashtrakuta** ruler Krishna I.

Why the other options are wrong:

- The Cholas built structural (not monolithic rock-cut) temples such as the Brihadeeswarar temple at Thanjavur.
- The Chandelas built the Khajuraho temples, structural Nagara temples in sandstone.
- The Pallavas carved the earlier monuments at Mahabalipuram, not Ellora's Kailasa.

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

Answer: (D) Go Back to Q5

Q6.

Solution

Concept – the Roman additions to the Greek orders: Besides using the three Greek orders, the Romans devised two of their own.

Step 1 – read the capital described: A capital that carries *both* the Ionic spiral volutes at its corners and the Corinthian acanthus leaves below them.

Step 2 – name it: This hybrid is the **Composite order**, the richest of the Roman orders, seen for example on the Arch of Titus.

Why the other options are wrong:

- The Tuscan order is the plainest Roman order, with a simple unfluted shaft and a plain capital – the opposite of ornate.
- The Doric order has a plain cushion capital with no volutes or leaves.
- The Aeolic is an early precursor of the Ionic, not a volute-plus-acanthus combination.

Final Answer: Composite order ⇒ $\boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept – reading structural behaviour from arch geometry: The shape of an arch controls how it channels load down to its supports.

Step 1 – compare the profiles: Arch P is a single-centred semicircle (Roman), Arch Q is a two-centred arch that rises to a point at the top (Gothic), and Arch R is a horseshoe arch that curves in below its widest point (Islamic).

Step 2 – pick the Gothic form: The **pointed arch (Arch Q)** carries its thrust line more steeply, so it exerts less outward thrust and can span taller, narrower bays. This is the structural signature of Gothic architecture.

Why the other options are wrong:

- The semicircular arch (P) is characteristic of Roman and Romanesque work and pushes out more strongly at the springing.
- The horseshoe arch (R) is characteristic of Islamic architecture, chosen largely for its form.
- A segmental arch is a shallow arc, less than a semicircle, used over wide openings, not the pointed Gothic form.

Final Answer: The pointed arch (Arch Q) $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept – the first written theory of architecture: The earliest surviving treatise on architecture sets out the qualities a good building must have.

Step 1 – recall the treatise: *De architectura* ("Ten Books on Architecture") was written in the 1st century BC.

Step 2 – recall the triad and the author: It lays down that architecture must have *firmitas* (strength), *utilitas* (usefulness) and *venustas* (beauty). Its author was the Roman architect-engineer **Vitruvius**.

Why the other options are wrong:

- Alberti wrote *De re aedificatoria* in the Renaissance, drawing on Vitruvius but much later.
- Palladio wrote *I Quattro Libri dell'Architettura*, again a Renaissance work.
- Vignola wrote a Renaissance treatise on the five orders, not the ancient triad.

Final Answer: Vitruvius $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q8

Q9.

Solution

Concept – traditional timber joints: Carpentry joints are named by how the two members are shaped to interlock.

Step 1 – read the description: One member ends in a projecting tongue; the other has a matching rectangular hole; the tongue is pushed into the hole.

Step 2 – name the parts and the joint: The projecting tongue is the *tenon* and the hole is the *mortise*, so the joint is the **mortise-and-tenon joint**. It is the classic strong joint for framing, doors and furniture.

Why the other options are wrong:

- A dovetail joint interlocks fan-shaped pins and tails, used mainly at box corners.

- A scarf joint splices two members end-to-end to make a longer piece.
- A butt joint simply places two square-cut ends together, the weakest joint, with no tongue or hole.

Final Answer: Mortise-and-tenon joint $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q9

Q10.

Solution

Concept – classifying brickwork bonds: A bond is the pattern in which bricks are laid so that vertical joints do not line up.

Step 1 – read the pattern: *Every* course shows headers and stretchers alternating side by side, and each header sits centred over the stretcher in the course below.

Step 2 – name it: Header-and-stretcher alternating within the *same* course is the **Flemish bond**. It gives a strong, good-looking wall and economises on facing bricks.

Why the other options are wrong:

- In a stretcher bond every brick is laid as a stretcher (used for half-brick partition walls).
- In a header bond every brick is laid as a header (used on curves and for thick walls).
- In an English bond, whole courses of headers *alternate with* whole courses of stretchers, so headers and stretchers are not mixed within one course.

Final Answer: Flemish bond $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q10

Q11.

Solution

Concept – the PERT three-time estimate: PERT treats each activity's duration as uncertain and blends three estimates using a beta-distribution weighting.

Step 1 – weight the three estimates: The most likely time t_m is given four times the weight of the two extremes:

$$t_e = \frac{t_o + 4t_m + t_p}{6}$$

Step 2 – check the total weight: The weights are $1 + 4 + 1 = 6$, so dividing by 6 gives a proper weighted mean.

Why the other options are wrong:

- $(t_o + t_m + t_p)/3$ is a plain average that ignores the extra weight on the most likely time.
- $(t_o + 2t_m + t_p)/4$ uses the wrong weights and divisor.
- $(t_o + t_m + 4t_p)/6$ wrongly puts the weight of 4 on the *pessimistic* time instead of the most likely time.

Final Answer: $t_e = \dfrac{t_o + 4t_m + t_p}{6} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q11

Q12.

Solution

Concept – applying the PERT expected-time formula: Substitute the three estimates into $t_e = (t_o + 4t_m + t_p)/6$.

Step 1 – list the data: $t_o = 4$ days, $t_m = 7$ days, $t_p = 16$ days.

Step 2 – form the weighted sum in the numerator: $t_o + 4t_m + t_p = 4 + 4(7) + 16$

Step 3 – evaluate $4t_m$: $4 \times 7 = 28$

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:

- 7 days is just t_m, the most likely time, not the weighted expected time.
- 9 and 10 days would need a larger numerator than 48.

Final Answer: $t_e = 8$ days $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q12

Q13.

Solution

Concept – variance of an activity in PERT: PERT takes the spread between the optimistic and pessimistic times to be six standard deviations.

Step 1 – write the standard deviation: $\sigma = \dfrac{t_p - t_o}{6}$

Step 2 – square it to get the variance: $\sigma^2 = \left(\dfrac{t_p - t_o}{6}\right)^2$

Step 3 – state the result: The activity variance is therefore $\left(\dfrac{t_p - t_o}{6}\right)^2$, and project variance along a path is the sum of the activity variances on it.

Why the other options are wrong:

- $(t_p - t_o)/6$ is the standard deviation, not the variance (it is not squared).
- $((t_p - t_o)/3)^2$ uses the wrong divisor.
- $(t_p + t_o)/6$ adds instead of subtracts and is not squared, so it is neither.

Final Answer: $\left(\dfrac{t_p - t_o}{6}\right)^2 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q13

Q14.

Solution

Concept – pozzolanas in lime mortar: Pure (fat) lime sets only slowly by absorbing carbon dioxide from the air and will not set in damp or enclosed conditions.

Step 1 – what surkhi does chemically: Surkhi is a pozzolana: its reactive silica and alumina combine with the lime in the presence of water to form insoluble, cementing compounds.

Step 2 – the practical effect: This makes the mortar **hydraulic**, so it can set and harden even in damp situations (such as foundations, wells and underwater work) and gains more strength than plain fat lime.

Why the other options are wrong:

- The red colour is only incidental; colour is not the purpose.
- Surkhi is not inert – it reacts chemically with the lime, so "only a filler" is wrong.
- It does not aim to lengthen the setting time; if anything a hydraulic mortar sets sooner.

Final Answer: imparts hydraulic properties $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q14

Q15.

Solution

Concept – total float of an activity: Total float is the spare time by which an activity may be delayed without delaying the whole project.

Step 1 – write the formula: Total float = Latest finish − Earliest finish

Step 2 – list the data for activity D: Earliest start = 8 days; duration = 4 days, so earliest finish = 8 + 4 = 12 days; latest finish = 17 days.

Step 3 – substitute: Total float = 17 − 12

Step 4 – evaluate: Total float = 5 days.

Why the other options are wrong:

- 4 days is the activity duration, not the float.
- 9 days wrongly uses 17 − 8 (latest finish minus earliest *start*).
- 3 days does not follow from the given values.

Final Answer: 5 days $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q15

Q16.

Solution

Concept – maximum moment of a simply supported beam under a UDL: For a full-span uniform load the maximum moment is at midspan and equals $wL^2/8$.

Step 1 – list the data: $w = 12$ kN/m, span $L = 8$ m.

Step 2 – write the formula: $M_{\max} = \dfrac{wL^2}{8}$

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

Step 4 – multiply by w: $wL^2 = 12 \times 64 = 768$

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

Why the other options are wrong:

- 48 kN·m uses $wL^2/16$.
- 24 kN·m halves that again.

- 12 kN·m merely repeats the load intensity.

Final Answer: $M_{\max} = 96$ kN·m $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q16

Q17.

Solution

Concept – naming truss members by the force they carry: In a pin-jointed truss with loads at the joints, every member carries only axial force – either compression or tension.

Step 1 – name the compression member: A member in axial compression is called a **strut**.

Step 2 – name the tension member: A member in axial tension is called a **tie**.

Step 3 – match the order asked: The question asks for "compression then tension", which is **strut and tie**.

Why the other options are wrong:

- "Tie and strut" reverses the order (tension first), so it does not match compression-then-tension.
- Beams and columns carry load mainly by bending and axial compression respectively; they are not the terms for truss members.
- Purlins and rafters are roof members named by position, not by whether they carry tension or compression.

Final Answer: Strut and tie $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q17

Q18.

Solution

Concept – support reactions of a simply supported beam: Take moments about one support to find the reaction at the other; a load nearer a support throws more of its weight onto that support.

Step 1 – list the data: Span $L = 6$ m; load $W = 30$ kN at $a = 2$ m from A (hence 4 m from B).

Step 2 – take moments about B (clockwise = anticlockwise): $R_A \times 6 = 30 \times$

$(6-2)$

Step 3 – evaluate the right side: $30 \times 4 = 120$

Step 4 – solve for R_A: $R_A = \dfrac{120}{6} = 20$ kN.

Step 5 – quick check: $R_B = 30 - 20 = 10$ kN, and the larger reaction (R_A) is correctly at the support nearer the load.

Why the other options are wrong:

- 10 kN is R_B, the reaction at the far support.
- 15 kN would be the case only for a central load.
- 30 kN is the whole applied load, not a single reaction.

Final Answer: $R_A = 20$ kN $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept – classifying stresses by the direction of the force: Stress is named by how the load acts on the plane of a cut through the body.

Step 1 – read the description: Two equal and opposite forces act *transversely* (parallel to the cut), so one part tends to slide over the other along that plane.

Step 2 – name it: A force acting tangential to a surface, causing sliding, produces **shear stress** ($\tau = P/A$, with P parallel to the area A).

Why the other options are wrong:

- Tensile stress arises from a pull *normal* to the section, stretching the body.
- Compressive stress arises from a push normal to the section, shortening it.
- Bearing stress is a contact pressure between two surfaces pressed together, not a sliding action.

Final Answer: Shear stress $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept – placing steel where the concrete is weak in tension: Concrete is strong in compression but weak in tension, so steel is put where tension occurs.

Step 1 – find the tension zone in sagging bending: When a beam sags (mid-span deflects downward), the top fibres shorten (compression) and the *bottom* fibres stretch (tension).

Step 2 – place the main steel: Because concrete cannot carry that bottom tension, the main tensile reinforcement is placed **near the bottom face**, where the tensile stress is greatest.

Why the other options are wrong:

- The top face is in compression in a sagging beam; concrete already resists that well.
- At the neutral axis the bending stress is zero, so steel there does little against bending.
- Spreading it uniformly wastes steel where it is not needed and under-provides at the bottom.

Final Answer: near the bottom face $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q20

Q21.

Solution

Concept – fixed-end moment of a cantilever under a UDL: A uniformly loaded cantilever has its greatest bending moment at the fixed support, equal to $wL^2/2$.

Step 1 – list the data: $w = 8$ kN/m, span $L = 3$ m.

Step 2 – find the total load and its centroid: Total load $W = wL = 8 \times 3 = 24$ kN, acting at the centre of the span, i.e. at $L/2 = 1.5$ m from the fixed end.

Step 3 – take the moment about the fixed support: $M = W \times \dfrac{L}{2} = 24 \times 1.5$

Step 4 – evaluate: $M = 36$ kN·m.

Step 5 – confirm with the standard formula: $M = \dfrac{wL^2}{2} = \dfrac{8 \times 3^2}{2} = \dfrac{8 \times 9}{2} = \dfrac{72}{2} = 36$ kN·m, which agrees.

Why the other options are wrong:

- 12 kN·m and 24 kN·m use a wrong lever arm or omit the factor.
- 72 kN·m is wL^2 without dividing by 2.

Final Answer: $M = 36$ kN·m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept – the wind tower as a passive cooling device: Hot-dry regions use built forms that catch and cool moving air without machinery.

Step 1 – read the section: A tall shaft rises above the roof; its openings at the top catch breeze at high level, where the air is cooler and cleaner, and lead it down into the living rooms.

Step 2 – name it: This is the **wind tower** (Persian *badgir*, Indian *malqaf*). Descending air can be cooled further by passing over water or damp surfaces, and warm room air is pushed out.

Why the other options are wrong:

- A Trombe wall is a solar-heating device (a glazed dark wall), the opposite purpose.
- A brise-soleil is an external sun-shading screen, not an air shaft.
- A light shelf is a horizontal element that bounces daylight deeper into a room; it does not move air.

Final Answer: Wind tower (badgir) $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept – how a courtyard cools a hot-dry house: The courtyard works with the large day-to-night temperature swing of a dry climate.

Step 1 – daytime behaviour: By day the shaded courtyard and the thick surrounding walls stay cooler than the outside air, and the walls store little heat because they are shaded.

Step 2 – night-time behaviour: At night the courtyard floor and walls, open to the clear sky, lose their heat by long-wave radiation to the cold night sky. The air in the court cools, becomes denser and settles down into the court and adjoining rooms.

Step 3 – state the mechanism: So the cooling is driven mainly by **night-sky radiation plus the settling of cool, dense night air** into the courtyard.

Why the other options are wrong:

- Admitting the midday sun deep into the rooms would heat, not cool, the house.
- A courtyard does not change the wall thickness.
- A fountain can add some evaporative cooling, but the main night mechanism is radiative loss and cool-air settling, not simply raising humidity.

Final Answer: night radiation to the sky and settling cool air $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept – why a horizontal overhang shades a south window: The effectiveness of a shading device depends on the sun's altitude on that facade.

Step 1 – recall the summer sun on the south: In the northern hemisphere, at solar noon in summer the sun is high in the sky (a large altitude angle) and shines on the south facade from steeply above.

Step 2 – relate to the overhang: Because the rays come down steeply, a *horizontal* projection casts a shadow that falls over the window below, cutting out the direct summer sun.

Step 3 – winter contrast (why it is a good device): In winter the noon sun is much lower, so its rays slip under the overhang and reach the glass, letting in useful warmth. This seasonal selectivity is what makes the overhang effective on the south.

Why the other options are wrong:

- East-only or west-only low sun describes the morning/evening sun that strikes east and west facades; those need *vertical* fins, not a horizontal overhang.
- The sun is certainly present in summer, so "absent" is false.

Final Answer: high midday altitude, so the overhang shades the glass $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q24

Q25.

Solution

Concept – steady-state heat flow through a wall: The conduction heat flow is $Q = U \times A \times \Delta T$, where U is the transmittance, A the area and ΔT the temperature difference.

Step 1 – list the data: $U = 2.5$ W/m^{2}K, $A = 10$ m^2, $\Delta T = 20°$C $= 20$ K.

Step 2 – multiply U by A: $U \times A = 2.5 \times 10 = 25$ W/K

Step 3 – multiply by ΔT: $Q = 25 \times 20$

Step 4 – evaluate: $Q = 500$ W.

Why the other options are wrong:

- 250 W uses half the area or half the ΔT.
- 50 W leaves out the temperature difference.
- 1000 W doubles the correct product.

Final Answer: $Q = 500 \text{ W} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q25

Q26.

Solution

Concept – passive solar heating with thermal mass and glazing: A dark, heavy wall behind glass stores solar heat and releases it slowly to the room.

Step 1 – read the description: A south wall, dark on the outside, with a glass pane a short distance in front. Sun passes the glass, is absorbed by the dark surface and heats the massive wall; the trapped warm air and the stored heat then reach the room.

Step 2 – name it: This is the **Trombe wall**, named after Felix Trombe, a classic passive-solar heating element for cold climates.

Why the other options are wrong:

- A cavity wall is two leaves with an air gap to resist damp and heat loss, not a glazed solar collector.
- A shear wall is a structural element resisting lateral loads.

- A parapet wall is the low wall at the edge of a roof, unrelated to solar heating.

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

Answer: (D) Go Back to Q26

Q27.

Solution

Concept – the stack (chimney) effect: Buoyancy differences drive air through a building when air at different temperatures has different densities.

Step 1 – describe the buoyancy: Warm indoor air is less dense (lighter) than the cooler outdoor air. Being lighter, it rises.

Step 2 – describe the resulting flow: The warm air escapes through high-level openings; this draws in cooler, denser air through low-level openings, setting up a continuous upward flow – ventilation without fans or wind.

Why the other options are wrong:

- Wind pressure produces cross-ventilation, a *different* driving force; the stack effect works even in still air.
- Fans are mechanical ventilation; the stack effect is by definition natural.
- Roof solar radiation is not the direct driver; the driver is the indoor-to-outdoor density difference.

Final Answer: warm air rises and escapes high while cool air enters low $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q27

Q28.

Solution

Concept – the daylight factor: $\text{DF} = \dfrac{\text{indoor illuminance}}{\text{outdoor illuminance}} \times 100\%$, comparing the light at a point inside with the light available outside.

Step 1 – list the data: Indoor illuminance $= 300$ lux; outdoor illuminance $= 15000$ lux.

Step 2 – form the ratio: $\dfrac{300}{15000} = 0.02$

Step 3 – convert to a percentage: $0.02 \times 100 = 2\%$

Step 4 – interpret: A daylight factor of about 2% is typical of adequately daylit interior space.

Why the other options are wrong:

- 5% would need an indoor illuminance of 750 lux.
- 20% misplaces the decimal point.
- 0.5% divides by four times too much.

Final Answer: $2\% \Rightarrow \boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ **Go Back to Q28**

Q29.

Solution

Concept – the landscape "invisible fence": English landscape gardens sought sweeping views with no visible barrier at the garden edge.

Step 1 – read the description: A sunken ditch, with a vertical retaining wall on the garden side and a gentle slope on the field side, so the boundary is hidden below the line of sight yet still stops livestock.

Step 2 – name it: This is the **ha-ha** (sunk fence). From the garden the ground appears to run unbroken to the countryside, keeping the view open while animals are kept out.

Why the other options are wrong:

- A pergola is an overhead frame for climbing plants, not a boundary ditch.
- A parterre is a formal ornamental planting bed.
- Topiary is the art of clipping shrubs into shapes, not a barrier.

Final Answer: Ha-ha $\Rightarrow \boxed{\text{A}}$

$\boxed{\textbf{Answer: (A)}}$ **Go Back to Q29**

Q30.

Solution

Concept – Lynch's idea of a readable city: Kevin Lynch judged good urban form by how easily people can form a clear mental map of it.

Step 1 – read what the layout does: Clearly named streets, distinct districts and visible landmarks help a newcomer understand the city's structure and find the way.

Step 2 – name the quality: This ease of being organised into a coherent mental image is **legibility** (Lynch's "imageability"), built from his five elements (paths, edges, districts, nodes, landmarks).

Why the other options are wrong:

- Density is persons or dwellings per unit area, a quantity, not a quality of understanding.
- Floor area ratio is a bulk-control number for a plot.
- Ground coverage is the fraction of a plot covered by building, again unrelated to wayfinding.

Final Answer: Legibility (imageability) $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q30

Q31.

Solution

Concept – elements of the formal (French) garden: The grand French garden is composed of ornamental ground patterns viewed from the house.

Step 1 – read the description: Symmetrical planting beds outlined by low, clipped box hedges arranged in decorative patterns, laid out to be seen from above.

Step 2 – name it: This is the **parterre**, the signature ground pattern of gardens such as Versailles (designed by Andre Le Notre).

Why the other options are wrong:

- An arboretum is a collection of trees grown for study or display.
- A "wilderness" in garden history is a densely planted grove with winding paths, not a patterned bed.
- An allotment is a small plot for growing vegetables, not an ornamental parterre.

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

Answer: (B) Go Back to Q31

Q32.

Solution

Concept – Camillo Sitte and the artistic critique of planning: Sitte studied the beauty of old European squares and drew lessons for modern city building.

Step 1 – recall his argument: In *City Planning According to Artistic Principles* (1889) he praised the irregular, enclosed, human-scaled squares of medieval towns and urged designers to compose spaces by eye and feeling.

Step 2 – identify what he was reacting against: He set this against the **rigid, monotonous gridiron plans** of 19th-century engineers, which he found visually dull and placeless.

Why the other options are wrong:

- The Garden City (Howard) and the Neighbourhood Unit (Perry) came later and are not what Sitte critiqued.
- Sitte admired the medieval town; he was not reacting *against* it.

Final Answer: the rigid, monotonous gridiron layouts $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q32

Q33.

Solution

Concept – linear green corridors: Open space can be planned not only as separate parks but as connected linear routes.

Step 1 – read the description: A linear strip of open land, often following a river, ridge or old railway, linking parks and natural areas and used for walking, cycling and wildlife movement.

Step 2 – name it: This is a **greenway**. By connecting green spaces it supports recreation and ecological corridors across the city.

Why the other options are wrong:

- A cul-de-sac is a dead-end street, not an open-space corridor.
- A building setback is the required gap between a building and the plot line.
- An easement is a legal right to use another's land (for a service run, say), not a recreational green corridor.

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

Answer: (B) Go Back to Q33

Q34.

Solution

Concept – Howard's "Three Magnets": Howard used a diagram of three magnets to explain the aim of the Garden City.

Step 1 – recall the three magnets: "Town" offers jobs and society but has slums, high rents and foul air; "Country" offers fresh air and nature but has few jobs and poor services; "Town-Country" is the proposed third option.

Step 2 – read the message: The Town-Country magnet was meant to draw people by **combining the advantages of both town and country while avoiding the drawbacks of each**.

Why the other options are wrong:

- Howard limited size and density; he did not seek to maximise central industrial density.
- He kept a permanent agricultural greenbelt, so abolishing agriculture is the opposite of his idea.
- He favoured low-rise, moderate-density towns, not high-rise blocks.

Final Answer: combine the advantages of town and country $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q34

Q35.

Solution

Concept – limiting Garden City size and growth by cells: Howard insisted a Garden City stay small and, on reaching its limit, spawn another rather than sprawl.

Step 1 – recall the target size: Each Garden City was to hold about $32{,}000$ people on roughly $6{,}000$ acres, most of it a permanent agricultural belt.

Step 2 – recall the growth rule: Once full, growth was to be taken by **founding a new Garden City** a little way off, so that a group of such towns would form a polycentric cluster around a larger central city – Howard's "Social City".

Why the other options are wrong:

- The greenbelt was permanent and protected; it was not to be built over.

- Howard's model was low-rise, so packing tower blocks into the centre is not it.
- Merging into the nearest industrial city is exactly the uncontrolled growth he wanted to avoid.

Final Answer: found a new Garden City nearby (a cluster) $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q35

Q36.

Solution

Concept – the built Garden Cities: Howard's ideas were tested by actually building new towns.

Step 1 – recall the first one: The first Garden City, begun in 1903 by the First Garden City Ltd., was **Letchworth** in Hertfordshire, master-planned by Raymond Unwin and Barry Parker.

Step 2 – note the second for contrast: Welwyn Garden City, the second, followed in 1920 – also Howard-inspired but later, so not the "first".

Why the other options are wrong:

- Welwyn Garden City was the second, not the first.
- Radburn (New Jersey) was a later American "town for the motor age", not a Howard Garden City.
- Milton Keynes was a British New Town of the 1960s, much later and different in scale.

Final Answer: Letchworth $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q36

Q37.

Solution

Concept – incremental (self-help) housing delivery: Low-income housing is often delivered by giving people a serviced plot rather than a finished house.

Step 1 – read the description: The agency provides a laid-out plot with water, drainage and a sanitary core; the family then builds and extends the house over time using its own labour and savings.

Step 2 – name it: This is a **sites-and-services scheme**, a widely used approach for affordable, incremental housing.

Why the other options are wrong:

- A turnkey contract delivers a fully finished building handed over ready to use – the opposite of incremental self-build.
- A transferable development right is a planning tool that lets unused development potential be moved to another site.
- A gated community is a type of enclosed private housing, not a delivery method for the poor.

Final Answer: Sites-and-services scheme $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q37

Q38.

Solution

Concept – number of dwelling units from population and household size: Dwelling units = population divided by the average number of persons per dwelling.

Step 1 – list the data: Population $= 8000$ persons; household size $= 5$ persons per dwelling.

Step 2 – write the relation: Dwelling units $= \dfrac{\text{population}}{\text{household size}}$

Step 3 – substitute: Dwelling units $= \dfrac{8000}{5}$

Step 4 – evaluate: Dwelling units $= 1600$.

Why the other options are wrong:

- 800 divides by 10 instead of 5.
- 1000 divides by 8.
- 4000 divides by 2.

Final Answer: 1600 dwelling units $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q38

Q39.

Solution

Concept – the Radburn "town for the motor age": Faced with rising car traffic, Stein and Wright reorganised the residential block for safety.

Step 1 – recall the key idea: Radburn (1929) grouped houses around large *superblocks*. Cars reached the houses only from short cul-de-sacs on the outside, while the houses turned their living sides inward to continuous interior parks.

Step 2 – name the innovation: Its central innovation was the **superblock with complete separation of pedestrian and vehicular movement**, so children could walk to school through parkland without crossing a main road at grade.

Why the other options are wrong:

- The high-rise tower in a park is Le Corbusier's model, not Radburn.
- The linear ribbon town is a different (linear-city) idea.
- The radial-concentric ideal city belongs to Renaissance planning, not Radburn.

Final Answer: the superblock with pedestrian-vehicle separation $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q39

Q40.

Solution

Concept – reading slope from contour spacing: On a map, the horizontal distance between successive contours tells us how steep the ground is.

Step 1 – recall the rule: Contours drawn for a fixed vertical interval are spaced by the horizontal distance needed to climb that interval. Closely spaced contours mean a large rise over a short horizontal distance.

Step 2 – apply it to the figure: On the left the contours are packed close together, so the ground climbs quickly there – it is **steep**. On the right the wide spacing means gentle ground.

Why the other options are wrong:

- Flat or gently sloping ground shows *widely* spaced contours, the opposite of close spacing.
- Close spacing says nothing about being below sea level.
- A water body is usually shown by a specific symbol/tint, not merely by close contours.

Final Answer: steep $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q40

Q41.

Solution

Concept – reduced level from a fore sight in the HI method: In the height-of-instrument method, the reduced level of a point is the instrument's line of collimation minus the staff reading (fore sight) taken on that point: $\text{RL} = \text{HI} - \text{FS}$.

Step 1 – list the data: $\text{HI} = 152.400$ m; fore sight $\text{FS} = 2.150$ m.

Step 2 – subtract the fore sight from the HI: $\text{RL} = 152.400 - 2.150$

Step 3 – evaluate: $\text{RL} = 150.250$ m.

Step 4 – interpret: The fore sight is subtracted because a larger staff reading means the point is that much *below* the line of sight.

Why the other options are wrong:

- 154.550 m *adds* the fore sight, which is the rule for a back sight, not a fore sight.
- 152.400 m ignores the fore sight (it is just the HI).
- 2.150 m is only the staff reading, not a reduced level.

Final Answer: $\text{RL} = 150.250 \text{ m} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q41

Q42.

Solution

Concept – gradient from rise over horizontal distance: A gradient is the vertical rise divided by the horizontal distance, usually written as "1 in n".

Step 1 – list the data: Vertical rise $= 2$ m; horizontal distance $= 40$ m.

Step 2 – form the ratio: $\text{Gradient} = \dfrac{\text{rise}}{\text{distance}} = \dfrac{2}{40}$

Step 3 – simplify: $\dfrac{2}{40} = \dfrac{1}{20}$

Step 4 – write in "1 in n" form: Gradient $= 1$ in 20 (a rise of 1 m for every 20 m of horizontal distance).

Why the other options are wrong:

- 1 in 5 would need a rise of 8 m over 40 m.
- 1 in 10 would need a rise of 4 m over 40 m.
- 1 in 40 uses the distance as the rise, ignoring the 2 m.

Final Answer: 1 in $20 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q42

Q43.

Solution

Concept – matching the survey instrument to the measurement: Each instrument is designed for a particular kind of survey measurement.

Step 1 – read what is needed: An instrument to measure *horizontal and vertical angles* accurately, whose electronic form with a built-in distance meter is the total station.

Step 2 – name it: This is the **theodolite**. The modern electronic theodolite integrated with an EDM (electronic distance meter) is precisely the total station.

Why the other options are wrong:

- A plane table is used for graphical plotting of detail directly in the field, not for precise angle values.
- A dumpy level measures differences in height (levelling), not horizontal and vertical angles.
- A prismatic compass measures magnetic bearings only, not vertical angles, and far less precisely.

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

Answer: (B) Go Back to Q43

Q44.

Solution

Concept – separate vs combined sewerage systems: Sewerage systems differ in whether foul sewage and storm water share the pipes.

Step 1 – define the separate system: In the **separate system** the sanitary (foul) sewage is carried in one set of sewers and the storm (rain) water in a completely *separate* set of drains.

Step 2 – note the benefit: Only the smaller foul flow reaches the treatment plant, so treatment units stay compact, and clean storm water can be discharged directly to a water body.

Why the other options are wrong:

- Carrying both in one pipe is the *combined* system, not the separate one.
- Discharging sewage untreated into a river is not a design system at all and is prohibited.
- A single common septic tank is an on-site disposal unit for a small building, not a town sewerage system.

Final Answer: carried in two separate pipe networks $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q44

Q45.

Solution

Concept – traffic flow from time headway: Flow (vehicles per hour) is the number of vehicles passing a point in an hour; it is the hour expressed in seconds divided by the average time gap between vehicles.

Step 1 – list the data: Average time headway $h = 3$ s per vehicle.

Step 2 – express one hour in seconds: 1 hour $= 3600$ s.

Step 3 – divide by the headway: $q = \dfrac{3600}{h} = \dfrac{3600}{3}$

Step 4 – evaluate: $q = 1200$ vehicles per hour.

Why the other options are wrong:

- 300, 600 and 900 veh/h correspond to headways of 12 s, 6 s and 4 s respectively, not 3 s.

Final Answer: 1200 vehicles per hour $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q45

Q46.

Solution

Concept – the purpose of camber (cross-fall): Camber is the transverse slope built into a carriageway, higher at the crown and falling to the edges.

Step 1 – read the section: The road surface slopes gently down from the central crown to both edges.

Step 2 – state the main purpose: This cross-fall lets **rain water run off the carriageway quickly** to the side drains, keeping the surface dry, preventing water from soaking into and weakening the pavement, and improving skid resistance.

Why the other options are wrong:

- Camber does not raise the design speed; geometry such as curve radius and sight distance governs speed.
- Super-elevation, not camber, is the one-way banking on curves that counters centrifugal force.
- Camber slightly increases (not reduces) earthwork/finishing effort; cost saving is not its purpose.

Final Answer: to drain rain water off the carriageway $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q46

Answer Key

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