

MAH M Arch CET Environment

Sample Paper – 3

Duration: 12 Minutes

Maximum Marks: 20

Instructions

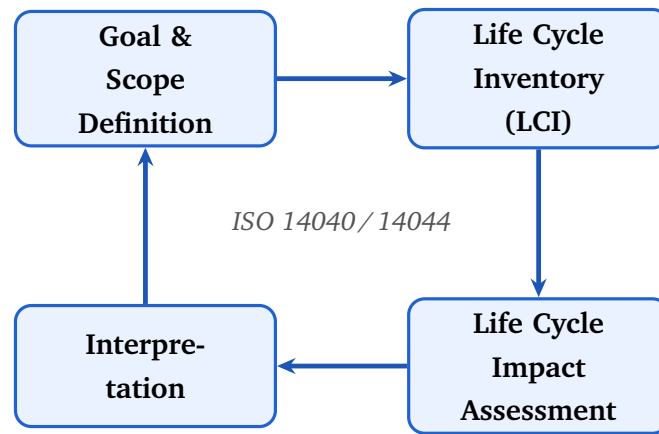
- This paper contains **10** Multiple Choice Questions (Single Correct Answer), modelled on the Environment portion of **MAH M Arch CET** entrance.
- Each correct answer carries **+2 marks**. There is **no negative marking** for incorrect or unattempted answers.
- Only **one** option is correct. Choose carefully.
- Syllabus: Ecology & Landscape Design, Environmental Design Strategies, Environmental Laws & Regulations.
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Q1. GRIHA (Green Rating for Integrated Habitat Assessment) is India's national green building rating system developed indigenously to suit local climatic conditions and building practices. Which of the following apex bodies administers and operates the GRIHA rating system?

- (A) Bureau of Energy Efficiency (BEE)
- (B) Ministry of Environment, Forest and Climate Change (MoEFCC)
- (C) Indian Green Building Council (IGBC)
- (D) TERI — The Energy and Resources Institute

Q2. The figure below illustrates the four inter-related phases of Life Cycle Assessment (LCA) as defined by ISO 14040/44. Which phase involves the systematic **compilation and quantification** of all inputs (raw materials, energy) and outputs (emissions, waste) associated with a product system throughout its life cycle?





- (A) Goal and Scope Definition
- (B) Life Cycle Inventory (LCI)
- (C) Life Cycle Impact Assessment (LCIA)
- (D) Interpretation

Q3. A passive daylighting device consisting of a horizontal, highly reflective surface mounted at or above eye level — positioned between a lower view window and an upper clerestory aperture — that bounces incoming sunlight onto the ceiling and distributes it deeper into the interior zone is called a:

- (A) Solar light pipe (tubular daylighting device)
- (B) Clerestory window
- (C) Light shelf
- (D) Electrochromic glazing panel

Q4. Composite wood products such as plywood, particleboard, and medium-density fibreboard (MDF), along with many interior adhesives, paints, and finishes, are recognised as the primary building-related source of which indoor air pollutant, classified as a Group 1 human carcinogen by the International Agency for Research on Cancer (IARC)?

- (A) Formaldehyde
- (B) Benzene
- (C) Radon



(D) Carbon monoxide

Q5. Greywater is broadly defined as domestic wastewater generated from household fixtures **other than** those connected to toilet waste. From the list below, identify the fixture that does **NOT** generate greywater:

(A) Bathroom lavatory (hand-wash basin)

(B) Kitchen sink and dishwasher

(C) Clothes-washing machine

(D) Water closet (toilet)

Q6. The Millennium Ecosystem Assessment (MEA) framework classifies ecosystem services into four categories: *provisioning*, *regulating*, *cultural*, and *supporting*. Which of the following services provided by wetlands is classified as a **regulating** ecosystem service?

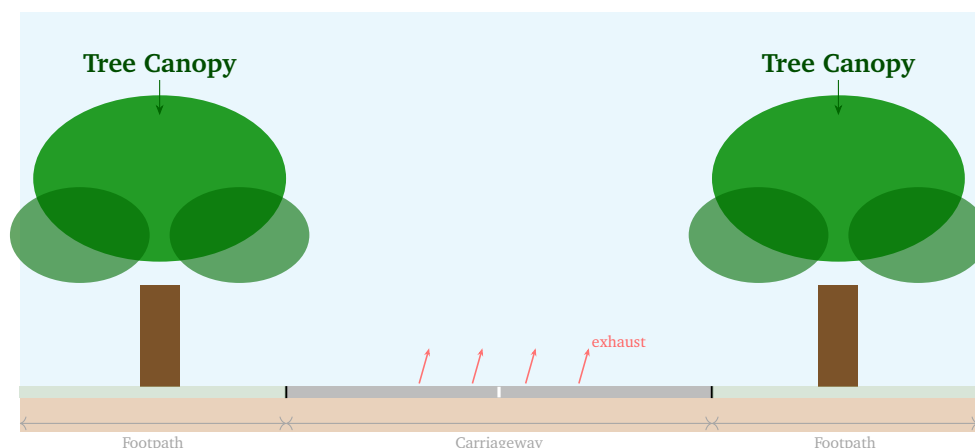
(A) Provision of freshwater for drinking and irrigation

(B) Flood attenuation and flow regulation

(C) Recreation, tourism, and aesthetic appreciation

(D) Soil formation and nutrient cycling support

Q7. The cross-section below depicts a typical urban street in an Indian city. When selecting tree species for street planting, which of the following characteristics is **most critical** for the long-term survival and functional effectiveness of the urban forest canopy?



- (A) Rapid height growth and maximum canopy spread
- (B) High water requirement and year-round dense shade
- (C) Tolerance to air pollution, compacted soils, and heat stress
- (D) Deep taproot system and edible fruit production

Q8. Soil erosion on vegetated slopes is a critical concern in landscape and environmental planning. Which of the following land cover types provides the **maximum** protection against rainfall-induced surface erosion on a steep slope?

- (A) Dense ground cover vegetation (grasses, creepers, and low shrubs)
- (B) Loose gravel mulch layer with no planting
- (C) Bare soil treated with contour furrows only
- (D) Impervious concrete paving without drainage channels

Q9. The Air (Prevention and Control of Pollution) Act, 1981 establishes India's framework for air quality management. Under this Act, which authority is empowered to lay down **National Ambient Air Quality Standards (NAAQS)**?

- (A) State Pollution Control Board (SPCB) of the concerned state
- (B) Ministry of Environment, Forest and Climate Change (MoEFCC)
- (C) National Environmental Engineering Research Institute (NEERI)
- (D) Central Pollution Control Board (CPCB)

Q10. The National Green Tribunal (NGT) was constituted under the National Green Tribunal Act, 2010, to adjudicate disputes involving substantial questions relating to the environment. Which of the following matters falls **outside** the NGT's jurisdiction?

- (A) Disputes arising under the Water (Prevention and Control of Pollution) Act, 1974
- (B) Matters relating exclusively to wildlife protection under the Wildlife (Protection) Act, 1972



- (C) Disputes arising under the Environment (Protection) Act, 1986
- (D) Matters relating to the Air (Prevention and Control of Pollution) Act, 1981



Detailed Solutions**Q1.****Solution**

Concept — GRIHA Rating System: GRIHA (Green Rating for Integrated Habitat Assessment) is India's indigenous national green building rating system, developed to suit the country's diverse climatic zones, local building materials, and construction practices.

Step 1 — Identify the governing body: GRIHA was jointly developed by **TERI (The Energy and Resources Institute)** and the Ministry of New and Renewable Energy (MNRE). TERI, through the GRIHA Council, administers the rating system, issues certificates, and conducts evaluations. The GRIHA rating awards one to five stars based on performance across site planning, construction management, building systems, and operational energy.

Step 2 — Distinguish from other bodies:

- BEE administers the Energy Conservation Building Code (ECBC) and the Bureau of Energy Efficiency star-rating for appliances — not GRIHA.
- MoEFCC oversees environmental regulations, EIA notifications, and policy — not green building rating systems.
- IGBC (Indian Green Building Council) administers its own IGBC Green Building Rating Systems and is the country partner for LEED India — a separate system from GRIHA.

Why other options are wrong:

- Option A (BEE): Manages energy efficiency labelling and ECBC; does not administer GRIHA.
- Option B (MoEFCC): Policy-making regulatory body; not a rating system administrator.
- Option C (IGBC): Administers its own IGBC and LEED India schemes; GRIHA belongs to TERI/GRIHA Council.

Final Answer: TERI – The Energy and Resources Institute administers GRIHA ⇒

D

Answer: (D) [Go Back to Q1](#)



Q2.

Solution

Concept — Life Cycle Assessment Phases (ISO 14040/44): LCA is a systematic methodology for evaluating the environmental burdens associated with a product, process, or activity throughout its entire life cycle, from raw material extraction to end-of-life. It comprises four sequential and iterative phases.

Step 1 — Recall the four LCA phases:

- *Goal and Scope Definition:* Establishes the purpose, intended audience, system boundary, and functional unit of the study.
- *Life Cycle Inventory (LCI):* Compiles and quantifies all inputs (raw materials, energy, water) and outputs (emissions to air, water, land; waste) for each process within the system boundary. This is the data-intensive phase.
- *Life Cycle Impact Assessment (LCIA):* Converts the LCI data into potential environmental impact scores (e.g., global warming potential in kg CO₂-eq, acidification, eutrophication).
- *Interpretation:* Evaluates the results from LCI and LCIA, identifies significant issues, checks consistency, draws conclusions, and makes recommendations.

Step 2 — Apply to the question: The question asks about the phase that “compiles and quantifies inputs and outputs” — this is precisely the definition of the **Life Cycle Inventory (LCI)** phase.

Why other options are wrong:

- Option A (Goal and Scope): Sets the framework and boundary; does not compile quantitative data.
- Option C (LCIA): Translates LCI results into impact categories; uses, rather than generates, inventory data.
- Option D (Interpretation): Synthesises results from LCI and LCIA; does not collect or compile raw data.

Final Answer: The Life Cycle Inventory (LCI) phase compiles and quantifies resource use and emissions ⇒ **B**

Answer: (B) [Go Back to Q2](#)



Q3.

Solution

Concept — Passive Daylighting Devices: Architects employ several passive strategies to redirect natural light deeper into building interiors, reducing reliance on artificial lighting and improving occupant visual comfort.

Step 1 — Define a light shelf: A **light shelf** is a horizontal, highly reflective surface (typically polished aluminium or painted white) mounted at or above eye level on the interior or exterior face of a window wall. It divides the window into two zones: a lower view glass (below the shelf) and an upper daylight aperture (above the shelf). Sunlight striking the shelf is reflected upward onto the ceiling and projected deep into the room beyond the perimeter zone, achieving more uniform illumination without direct glare.

Step 2 — Distinguish from other devices:

- Solar light pipe: A reflective cylindrical tube that captures daylight at roof level and channels it vertically to interior spaces — it is roof-mounted and uses total internal reflection, not a window-level reflective surface.
- Clerestory window: A high-level window that admits light from above; it is a passive aperture, not a reflective redirection device.
- Electrochromic glazing: Smart glass that changes its tint electrochemically to control glare and solar gain; it modulates light transmission but does not redirect light.

Why other options are wrong:

- Option A: Light pipes transport light via tubes from the roof; they do not reflect light off a ceiling from a window position.
- Option B: Clerestories are apertures that let light in; they do not actively redirect it via reflection.
- Option D: Electrochromic glass controls solar gain and glare; it does not redirect daylight deeper into the room.

Final Answer: The light shelf redirects daylight deeper into the interior via ceiling reflection ⇒

Answer: (C) [Go Back to Q3](#)



Q4.

Solution**Concept — Indoor Air Quality and VOC Emissions from Building Materials:**

Volatile organic compounds (VOCs) released by interior building materials are a leading cause of poor indoor air quality. Composite wood products manufactured with formaldehyde-based resins are among the most significant sources.

Step 1 — Identify the primary pollutant: Formaldehyde (HCHO) is the predominant VOC emitted by composite wood products. Plywood, MDF, and particle-board are typically bonded with urea-formaldehyde (UF) or phenol-formaldehyde (PF) resins, which off-gas formaldehyde over time — a process that continues for months to years after installation. Many interior adhesives, paints, and lacquers are also formaldehyde sources. The IARC (International Agency for Research on Cancer) classifies formaldehyde as a Group 1 human carcinogen, with documented links to nasopharyngeal cancer and leukaemia.

Step 2 — Compare with other pollutants:

- Benzene: Emitted by combustion, tobacco smoke, and certain solvents; not the primary emission from composite wood panels.
- Radon: A naturally occurring radioactive gas that migrates from soil and rock into buildings through foundation gaps; entirely unrelated to wood products.
- Carbon monoxide: A byproduct of incomplete combustion (gas appliances, generators, vehicles); not emitted by composite wood or adhesives.

Why other options are wrong:

- Option B (Benzene): Associated with combustion and fuel sources, not composite wood manufacture.
- Option C (Radon): Geological origin; building material type is irrelevant to radon entry.
- Option D (Carbon monoxide): Combustion byproduct; composite wood does not combust during normal use.

Final Answer: Formaldehyde is the primary indoor air pollutant from composite wood products and adhesives ⇒ A

Answer: (A) [Go Back to Q4](#)



Q5.

Solution

Concept — Greywater vs. Blackwater: In building water management, domestic wastewater is broadly classified by contamination level. **Greywater** is wastewater from sinks, showers, baths, and washing machines — it is relatively lightly contaminated and suitable for treatment and reuse (e.g., toilet flushing, landscape irrigation). **Blackwater** (also called sewage) contains faecal matter and pathogens from toilets and urinals, requiring full sewage treatment before any reuse.

Step 1 — Classify each fixture:

- Bathroom lavatory (hand-wash basin): Generates *greywater* — lightly contaminated wash water.
- Kitchen sink and dishwasher: Generate *greywater* (some codes classify kitchen water as “dark greywater” due to food residues and grease, but it is still greywater, not blackwater).
- Clothes-washing machine: Generates *greywater* containing detergents, dirt, and lint.
- Water closet (toilet): Generates **blackwater** because the discharge contains faecal matter and urine, making it highly pathogenic — it is categorically *not* greywater.

Step 2 — Apply to the question: Only the water closet (toilet) produces blackwater; all other listed fixtures produce greywater.

Why other options are wrong:

- Option A: Bathroom lavatory is a classic greywater source.
- Option B: Kitchen sink produces greywater (dark greywater); still greywater by definition.
- Option C: Washing machine is a standard and commonly recycled greywater source.

Final Answer: The water closet (toilet) generates blackwater, not greywater ⇒

D

Answer: (D)

[Go Back to Q5](#)

Q6.

Solution

Concept — Wetland Ecosystem Services (MEA Framework): The Millennium Ecosystem Assessment (2005) defined and categorised the benefits that ecosystems provide to human wellbeing into four types. Understanding these categories is essential for environmental planning and conservation policy.

Step 1 — Define the four service categories:

- *Provisioning services:* Products obtained from ecosystems (food, freshwater, timber, fibre, fuel).
- *Regulating services:* Benefits obtained from regulation of ecosystem processes (climate regulation, flood regulation, water purification, disease control).
- *Cultural services:* Non-material benefits (recreation, spiritual value, aesthetic appreciation, education).
- *Supporting services:* Services necessary for production of all other ecosystem services (soil formation, nutrient cycling, primary production, oxygen production).

Step 2 — Classify each option:

- Option A (provision of freshwater): *Provisioning* — wetlands store and supply water directly.
- Option B (flood attenuation and flow regulation): *Regulating* — wetlands buffer floodwaters, slow runoff, and moderate river flows; this is an active regulation of a natural hazard process.
- Option C (recreation, tourism, aesthetic appreciation): *Cultural* — non-material benefits to human wellbeing.
- Option D (soil formation and nutrient cycling): *Supporting* — underlying processes that enable all other services.

Why other options are wrong:

- Option A: Provisioning service, not regulating.
- Option C: Cultural service, not regulating.
- Option D: Supporting service, not regulating (supporting services are the ecological foundation, not direct benefits).

Final Answer: Flood attenuation and flow regulation is a regulating ecosystem service of wetlands ⇒ B

Answer: (B) [Go Back to Q6](#)



Q7.

Solution

Concept — Urban Tree Species Selection in Indian Cities: Urban environments subject street trees to simultaneous stresses that differ fundamentally from natural forest conditions. Species selection must prioritise survival under these conditions before aesthetics or secondary functional benefits.

Step 1 — Identify key urban stresses for street trees in India:

- **Air pollution:** High concentrations of vehicular NO_x, particulate matter (PM_{2.5}, PM₁₀), SO₂, and ozone from dense traffic.
- **Compacted soils:** Pavement construction and foot/vehicle traffic compact the soil, reducing aeration, water infiltration, and rooting volume.
- **Heat stress:** Urban Heat Island effect elevates ambient temperatures 2–5°C above rural areas; tree pits with limited soil volume also heat rapidly.
- **Periodic drought:** Limited soil volume combined with competing demands reduces available moisture.
- **Physical damage:** Vehicle impacts, pedestrian activity, and utility work cause repeated physical injury.

Step 2 — Evaluate each option:

- Option A (rapid height growth + maximum spread): Desirable secondary trait but meaningless if the tree cannot survive pollution and heat; tall fast-growing species are often brittle and stress-susceptible.
- Option B (high water requirement + dense shade): High water requirement is a critical liability in Indian cities with limited urban irrigation and frequent drought spells.
- **Option C (tolerance to pollution, compacted soils, heat stress):** The foundational prerequisite. Species such as *Pongamia pinnata*, *Tamarindus indica*, *Ficus* spp., and *Cassia fistula* are selected for Indian urban streets precisely because of these tolerances.
- Option D (deep taproot + edible fruit): Deep taproots conflict with underground utility infrastructure; fruit production is irrelevant to urban forestry objectives and may create hazards (slipping, pest attraction).

Why other options are wrong:

- Option A: Growth rate is secondary; pollution intolerance leads to decline and death.
- Option B: High water demand conflicts with urban water scarcity and limited soil volume.



- Option D: Taproot depth is a liability near utilities; fruit production is not an urban planting criterion.

Final Answer: Tolerance to air pollution, compacted soils, and heat stress is the most critical characteristic $\Rightarrow$

Answer: (C) [Go Back to Q7](#)

Q8.

Solution

Concept — Soil Erosion Mechanisms and Protective Land Cover: Rainfall-induced soil erosion on slopes occurs through two linked mechanisms: (i) *raindrop impact* (splash detachment) — the kinetic energy of raindrops dislodges soil particles; and (ii) *surface runoff transport* — overland flow carries detached particles downslope. Effective erosion control must interrupt both mechanisms.

Step 1 — Evaluate each cover type:

- **Dense ground cover vegetation:** (i) Leaf canopy and stems intercept raindrops, dissipating kinetic energy before they reach the soil surface (preventing splash detachment); (ii) root systems physically bind soil particles; (iii) organic matter and root channels increase soil macroporosity, enhancing infiltration and reducing overland flow. This provides integrated three-stage protection and is consistently ranked highest in erosion control literature (e.g., Universal Soil Loss Equation: very low C factor for dense vegetation).
- **Loose gravel mulch:** Intercepts raindrop impact but provides no root binding; heavy rainfall can displace gravel on steep slopes; infiltration improvement is limited.
- **Bare soil with contour furrows:** Contour furrows slow runoff velocity, but exposed bare soil remains fully vulnerable to splash detachment; no root binding; moderate protection only.
- **Impervious concrete paving:** Eliminates erosion on the paved surface itself but generates 100% runoff, concentrating flow at unprotected edges and causing severe erosion at pavement margins; also creates waterlogging and is inappropriate for natural slopes.

Step 2 — Confirm the best option: Dense vegetation alone addresses all three mechanisms — interception, root binding, and infiltration — making it the universally preferred erosion control strategy for natural slopes.

Why other options are wrong:



- Option B: Gravel lacks root binding and can be displaced; limited in steep-slope applications.
- Option C: Contour furrows address runoff but leave soil exposed to raindrop impact.
- Option D: Paving relocates rather than prevents erosion; not suitable for sloped natural areas.

Final Answer: Dense ground cover vegetation provides maximum protection against slope erosion $\Rightarrow$

Answer: (A) [Go Back to Q8](#)

Q9.

Solution

Concept — Air (Prevention and Control of Pollution) Act, 1981 and the Role of CPCB: The Air Act, 1981 established India's statutory framework for the prevention, control, and abatement of air pollution. It created a two-tier regulatory structure with the Central Pollution Control Board (CPCB) at the national level and State Pollution Control Boards (SPCBs) at the state level.

Step 1 — Identify the standard-setting authority: Section 16(2)(h) of the Air Act, 1981 empowers the **Central Pollution Control Board (CPCB)** to lay down standards for the quality of air. Pursuant to this, the CPCB notified the National Ambient Air Quality Standards (NAAQS), most recently revised in 2009, specifying permissible concentration limits for PM₁₀, PM_{2.5}, SO₂, NO₂, CO, ozone, lead, ammonia, and benzene.

Step 2 — Clarify the roles of the other bodies:

- SPCBs: May prescribe more stringent standards for their respective states but *cannot* set national standards; primarily responsible for enforcement (grant/refuse consent to industry), monitoring, and reporting to CPCB.
- MoEFCC: The parent ministry that makes policy and issues rules under the Environment (Protection) Act; it does not itself prescribe NAAQS under the Air Act.
- NEERI: A CSIR research institute providing technical expertise, testing, and research support; it has no statutory authority under the Air Act.

Why other options are wrong:

- Option A (SPCB): Enforcement and state-level implementation; not empowered to set national ambient standards.



- Option B (MoEFCC): Policy and overarching environment regulation; NAAQS are set by CPCB under the Air Act, not by MoEFCC.
- Option C (NEERI): Research body with no statutory standard-setting role.

Final Answer: The Central Pollution Control Board (CPCB) is empowered to prescribe National Ambient Air Quality Standards ⇒ D

Answer: (D) [Go Back to Q9](#)

Q10.

Solution

Concept — National Green Tribunal (NGT) Jurisdiction: The NGT Act, 2010 grants the NGT jurisdiction over disputes involving substantial questions relating to the environment arising under seven specific Acts listed in Schedules I and II of the NGT Act. Matters arising under Acts *not* in the schedule remain with civil courts, High Courts, or the Supreme Court.

Step 1 — List the seven Acts scheduled under the NGT Act, 2010:

1. The Water (Prevention and Control of Pollution) Act, 1974
2. The Water (Prevention and Control of Pollution) Cess Act, 1977
3. The Forest (Conservation) Act, 1980
4. The Air (Prevention and Control of Pollution) Act, 1981
5. The Environment (Protection) Act, 1986
6. The Public Liability Insurance Act, 1991
7. The Biological Diversity Act, 2002

Step 2 — Apply to each option:

- Option A (Water Act, 1974): **Scheduled** — fully within NGT jurisdiction.
- Option B (Wildlife Protection Act, 1972): **NOT in the schedule** — the Wildlife (Protection) Act, 1972 is explicitly absent from the NGT Act schedule. Disputes arising exclusively under this Act are handled by civil courts or referred to the Supreme Court and High Courts. (Note: where wildlife matters are intertwined with EPA 1986 or Forest Conservation Act 1980, NGT may still have jurisdiction on those aspects.)
- Option C (Environment Protection Act, 1986): **Scheduled** — within NGT jurisdiction.
- Option D (Air Act, 1981): **Scheduled** — within NGT jurisdiction.

Why other options are wrong:



- Options A, C, and D: All correspond to Acts explicitly listed in the schedule to the NGT Act, 2010; NGT has full jurisdiction over disputes under these Acts.

Final Answer: The Wildlife (Protection) Act, 1972 is NOT in the NGT Act schedule; those matters fall outside NGT's jurisdiction ⇒

Answer: (B) [Go Back to Q10](#)



Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	D	2	B	3	C	4	A	5	D
6	B	7	C	8	A	9	D	10	B

