

CUET PG 2026 Environmental Sciences Question Paper with Solutions

Time Allowed :1 Hour 30 Minutes	Maximum Marks :300	Total Questions :75
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General Instructions

Read the following instructions very carefully and strictly follow them:

- The Question Paper consists of 75 Multiple Choice Questions (MCQs).
- Total marks for the exam is 300.
- The total duration is 90 minutes; a timer on the screen will display the remaining time, and the exam will automatically submit when the time reaches zero.
- For every correct answer, 4 marks (+4) will be awarded to the candidate, and a 1 mark (-1) will be deducted for every incorrect answer.
- Question papers are available in both English and Hindi.

1. Which of the following layers of the atmosphere contains the ozone layer that absorbs UV radiation?

- (A) Troposphere
- (B) Stratosphere
- (C) Mesosphere
- (D) Thermosphere

Correct Answer: (B) Stratosphere

Solution:

Step 1: Understanding the Question: We need to identify the specific atmospheric layer that houses the ozone layer, which is responsible for absorbing harmful ultraviolet (UV) radiation from the Sun.

Step 2: Key Concept: Earth's atmosphere is structurally divided into multiple layers based on altitude and temperature profiles: Troposphere, Stratosphere, Mesosphere, Thermosphere, and Exosphere.

Step 3: Detailed Explanation:

The lowest layer is the Troposphere, extending up to about 10 to 15 km, where all weather phenomena occur.

Above the troposphere lies the Stratosphere, extending up to an altitude of about 50 km.

The ozone layer is a high-concentration region of ozone (O_3) molecules located primarily within the lower portion of the stratosphere.

This vital layer acts as a protective shield, absorbing the majority of the Sun's harmful UV-B and UV-C radiation.

The other higher layers, such as the Mesosphere (where meteors burn up) and Thermosphere (where auroras occur), do not contain the ozone layer.

Step 4: Final Answer: Thus, the correct atmospheric layer containing the ozone layer is the Stratosphere.

 Quick Tip

Remember the mnemonic 'The Smart Man Takes the Elevator': Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere.
The **Ozone layer** is securely placed in the **Stratosphere**.

2. In Bowen's Reaction Series, which mineral is the first to crystallize from a cooling silicate magma?

- (A) Quartz
- (B) Olivine
- (C) Biotite
- (D) Muscovite

Correct Answer: (B) Olivine

Solution:

Step 1: Understanding the Question: The question requires identifying the very first mineral to crystallize from a cooling silicate magma according to Bowen's Reaction Series.

Step 2: Key Concept: Bowen's Reaction Series explains the specific sequence in which minerals solidify as magma cools over time.

It consists of a discontinuous branch for ferromagnesian minerals and a continuous branch for plagioclase feldspars.

Step 3: Detailed Explanation:

In the discontinuous series, minerals crystallize in a very strict order as the temperature of the magma drops.

The sequence follows: Olivine → Pyroxene → Amphibole → Biotite.

Olivine is the first to crystallize because it forms at the highest temperatures (around 1200° C). On the other hand, minerals like Quartz, Muscovite, and Potassium Feldspar crystallize last at the lowest temperatures (around 750° C).

Therefore, Olivine is the first mineral to solidify from the cooling melt.

Step 4: Final Answer: The correct answer is Olivine.

💡 Quick Tip

For the discontinuous series, remember 'Old People Are Boring': Olivine, Pyroxene, Amphibole, Biotite.

Olivine always forms first at the highest temperature!

3. What is the primary chemical responsible for Minamata disease in humans?

- (A) Lead
- (B) Mercury
- (C) Arsenic
- (D) Cadmium

Correct Answer: (B) Mercury

Solution:

Step 1: Understanding the Question: We need to identify the specific toxic heavy metal that caused the devastating outbreak of Minamata disease.

Step 2: Key Concept: Minamata disease is a severe neurological syndrome caused by heavy metal poisoning, specifically through the biomagnification of methylmercury in aquatic food webs.

Step 3: Detailed Explanation:

The disease was first discovered in Minamata city, Japan, in 1956.

A local chemical manufacturing plant continuously released untreated industrial wastewater containing methylmercury into Minamata Bay.

This toxic, organic mercury compound was readily absorbed by marine life and bioaccumulated up the food chain into fish and shellfish.

Humans who consumed the contaminated seafood suffered from severe mercury poisoning.

The poisoning caused irreversible central nervous system damage, leading to symptoms like numbness, loss of coordination, paralysis, and death.

Other options like Lead, Arsenic, and Cadmium cause entirely different specific illnesses.

Step 4: Final Answer: The primary chemical responsible for Minamata disease is Mercury.

💡 Quick Tip

Match the toxic heavy metal to its respective disease:

Mercury → Minamata Disease.

Cadmium → Itai-Itai Disease.

Lead → Plumbism (Neurological and developmental issues).

4. Calculate the energy of a photon (in Joules) with a wavelength of 500 nm, given $h = 6.6 \times 10^{-34}$ Js.

- (A) 3.96×10^{-19} J
- (B) 1.98×10^{-19} J
- (C) 5.00×10^{-19} J
- (D) 7.92×10^{-19} J

Correct Answer: (A) 3.96×10^{-19} J

Solution:

Step 1: Understanding the Question: We are tasked with calculating the energy of a single photon given its wavelength ($\lambda = 500$ nm) and Planck's constant (h).

Step 2: Key Formula and Approach:

The energy (E) of a photon can be calculated using the Planck-Einstein relation:

$$E = \frac{hc}{\lambda}$$

where h is Planck's constant (6.6×10^{-34} Js), c is the speed of light (3×10^8 m/s), and λ is the wavelength in standard SI units (meters).

Step 3: Detailed Explanation:

First, we must convert the given wavelength from nanometers to meters to ensure unit consistency:

$$\lambda = 500 \text{ nm} = 500 \times 10^{-9} \text{ m} = 5 \times 10^{-7} \text{ m}$$

Next, we substitute the known values into the energy formula:

$$E = \frac{(6.6 \times 10^{-34}) \times (3 \times 10^8)}{5 \times 10^{-7}}$$

We simplify the numerator by multiplying the constants and their respective powers of ten:

$$6.6 \times 3 = 19.8$$

$$10^{-34} \times 10^8 = 10^{-26}$$

So, the numerator evaluates to $19.8 \times 10^{-26} \text{ J} \cdot \text{m}$.

Now, we divide this result by the denominator:

$$E = \frac{19.8 \times 10^{-26}}{5 \times 10^{-7}}$$

$$E = \left(\frac{19.8}{5} \right) \times 10^{-26-(-7)}$$

$$E = 3.96 \times 10^{-19} \text{ J}$$

Step 4: Final Answer: The calculated energy of the photon is $3.96 \times 10^{-19} \text{ J}$.

💡 Quick Tip

Always ensure your units are consistent before calculating!

Convert wavelengths from nm (10^{-9} m) or μm (10^{-6} m) to meters so that they cancel properly with the speed of light (m/s).

5. Which global agreement specifically targets the phase-out of Ozone Depleting Substances (ODS)?

- (A) Kyoto Protocol
- (B) Paris Agreement
- (C) Montreal Protocol
- (D) Basel Convention

Correct Answer: (C) Montreal Protocol

Solution:

Step 1: Understanding the Question: The question requires identifying the specific international treaty drafted to eliminate the production and use of Ozone Depleting Substances (ODS).

Step 2: Key Concept: Different global environmental agreements are formulated to address specific ecological crises.

ODS are synthetic chemicals, such as chlorofluorocarbons (CFCs) and halons, that catalytically destroy the stratospheric ozone layer.

Step 3: Detailed Explanation:

The Montreal Protocol on Substances that Deplete the Ozone Layer was finalized and adopted in 1987.

Its primary, legally binding objective is the worldwide phase-out of ODS to repair and protect the Earth's delicate ozone shield.

Let us evaluate the other available options for clarity:

The Kyoto Protocol is an older treaty that focuses on reducing greenhouse gas emissions to mitigate climate change.

The Paris Agreement is a more recent global framework aiming to limit overall global temperature rise.

The Basel Convention strictly regulates the transboundary movements and disposal of hazardous solid and chemical wastes.

Step 4: Final Answer: The correct agreement targeting ODS is the Montreal Protocol.

 Quick Tip

Use key environmental keywords to associate treaties:

Montreal = Ozone Layer (ODS).

Kyoto / Paris = Climate Change (Greenhouse Gases).

Basel = Hazardous Wastes.

Ramsar = Wetlands Conservation.

6. In an aquatic ecosystem, what does a high Biological Oxygen Demand (BOD) value indicate about water quality?

- (A) High dissolved oxygen and clean water
- (B) Low organic pollution in water
- (C) High level of organic pollution and poor water quality
- (D) High mineral content in water

Correct Answer: (C) High level of organic pollution and poor water quality

Solution:

Step 1: Understanding the Question: The question tests the understanding of Biological Oxygen Demand (BOD) and what a relatively high value indicates regarding the overall quality of water.

Step 2: Key Concept: BOD measures the total amount of dissolved oxygen consumed by aerobic microorganisms when they decompose organic matter in water over a specified time period.

Step 3: Detailed Explanation:

When untreated sewage, agricultural runoff, or organic industrial waste enters a water body, it serves as an abundant food source for bacteria and other microbes.

As these microorganisms rapidly multiply and break down the organic matter, they consume available dissolved oxygen (DO) from the water column.

A high BOD implies that there is a massive amount of organic waste present, which requires a proportionately large amount of oxygen for its complete decomposition.

Consequently, the dissolved oxygen levels in the water drop significantly, creating hypoxic conditions that make it exceedingly difficult for larger aquatic life, like fish, to survive.

Therefore, a high BOD directly corresponds to a high level of organic pollution and severely degraded water quality.

Step 4: Final Answer: High BOD firmly indicates a high level of organic pollution and inherently poor water quality.

💡 Quick Tip

BOD and DO (Dissolved Oxygen) share an inverse relationship in aquatic ecosystems!

High BOD → High Organic Matter → Low DO → Highly Polluted Water.

Low BOD → Low Organic Matter → High DO → Clean, Healthy Water.

7. According to the Mohs Scale of Hardness, which mineral has a relative hardness value of 9?

- (A) Quartz
- (B) Diamond
- (C) Corundum
- (D) Topaz

Correct Answer: (C) Corundum

Solution:

Step 1: Understanding the Question: We are asked to correctly identify the mineral that occupies the number 9 spot on the Mohs scale of hardness.

Step 2: Key Concept: The Mohs scale of mineral hardness evaluates the scratch resistance of various minerals.

It ranges from 1 (the softest) to 10 (the hardest), based on the ability of a harder material to visibly scratch a softer one.

Step 3: Detailed Explanation:

Let's systematically review the upper end of the standard Mohs hardness scale:

Hardness 7 is assigned to Quartz.

Hardness 8 is assigned to Topaz.

Hardness 9 is assigned to Corundum, which chemically is aluminum oxide (Al_2O_3) and encompasses precious gemstones like ruby and sapphire.

Hardness 10 is assigned to Diamond, universally recognized as the hardest naturally occurring mineral on Earth.

Because the question specifically asks for the mineral representing a hardness value of 9, Corundum is the undeniable match.

Step 4: Final Answer: The correct mineral for hardness 9 is Corundum.

💡 Quick Tip

Memorize the entire Mohs scale using this fun mnemonic:

Tall Girls Can Flirt And Other Queer Things Can Do.

(Talc = 1, Gypsum = 2, Calcite = 3, Fluorite = 4, Apatite = 5, Orthoclase = 6, Quartz = 7, Topaz = 8, Corundum = 9, Diamond = 10).

8. Which type of ecological pyramid can never be inverted in any ecosystem?

- (A) Pyramid of Numbers
- (B) Pyramid of Biomass
- (C) Pyramid of Energy
- (D) Pyramid of Population

Correct Answer: (C) Pyramid of Energy

Solution:

Step 1: Understanding the Question: The question requires identifying which of the foundational ecological pyramids is strictly always upright and mathematically can never take an inverted shape.

Step 2: Key Concept: Ecological pyramids are graphical representations that illustrate the trophic structure and functional dynamics within ecosystems.

They prominently include the pyramids of numbers, biomass, and energy.

Step 3: Detailed Explanation:

The Pyramid of Numbers can be easily inverted, for example, when numerous small parasitic insects feed on a single large oak tree.

The Pyramid of Biomass can also be inverted, particularly in aquatic ecosystems where the

standing crop biomass of rapidly reproducing phytoplankton (producers) is often less than the biomass of the longer-lived zooplankton (primary consumers) at any given moment. However, the Pyramid of Energy is fundamentally governed by the inviolable laws of thermodynamics.

According to Lindeman's 10% rule of energy transfer, only about 10% of the energy is successfully passed from one trophic level to the next.

The remaining 90% is inevitably lost to the environment, primarily as heat generated during respiratory and metabolic processes.

Because total energy strictly decreases as it flows upwards from producers to top consumers, the base of the pyramid must always be the widest.

Step 4: Final Answer: Therefore, the Pyramid of Energy is always upright and can never be inverted.

💡 Quick Tip

Energy flow is strictly unidirectional in ecology!

Because significant energy is always lost as heat at every single trophic level due to the Second Law of Thermodynamics, the **Pyramid of Energy** can never be inverted.

9. The Kyoto Protocol was primarily designed to reduce the emission of which type of gases?

- (A) Ozone-depleting gases
- (B) Greenhouse gases
- (C) Noble gases
- (D) Radioactive gases

Correct Answer: (B) Greenhouse gases

Solution:

Step 1: Understanding the Question: The core objective here is to correctly identify the primary target category of gases that the Kyoto Protocol was internationally drafted to reduce.

Step 2: Key Concept: The Kyoto Protocol is a landmark international treaty that operationalized the United Nations Framework Convention on Climate Change (UNFCCC).

Step 3: Detailed Explanation:

Formally adopted in 1997 in Kyoto, Japan, the protocol boldly commits industrialized nations and economies in transition to strictly limit and systematically reduce their emissions of greenhouse gases (GHGs).

The protocol meticulously targets a recognized basket of six major GHGs responsible for global warming: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons

(HFCs), Perfluorocarbons (PFCs), and Sulfur hexafluoride (SF_6).

Evaluating the other options: Ozone-depleting gases are robustly handled by the Montreal Protocol, not Kyoto.

Noble gases are chemically inert and have absolutely no bearing on climate change dynamics.

Radioactive gases are governed by separate nuclear safety treaties and are completely unrelated to the Kyoto Protocol's mandate.

Step 4: Final Answer: The Kyoto Protocol was primarily designed to reduce greenhouse gases.

 Quick Tip

Remember the historical timeline of global protocols:

Kyoto (1997) focuses strictly on mitigating Climate Change by targeting **Greenhouse Gases (GHGs)**.

It primarily placed heavier emission-reduction burdens on developed nations under the principle of "common but differentiated responsibilities".

10. Which plant group is considered the "amphibians of the plant kingdom" due to their requirement for water during fertilization?

- (A) Pteridophytes
- (B) Gymnosperms
- (C) Bryophytes
- (D) Angiosperms

Correct Answer: (C) Bryophytes

Solution:

Step 1: Understanding the Question: We need to identify the distinct plant group that is universally famous as the "amphibians of the plant kingdom" because of their dual evolutionary dependency on land and water.

Step 2: Key Concept: Plant kingdoms are categorically divided into several broad groups based on their structural and evolutionary reproductive traits.

Just as true amphibians in the animal kingdom inhabit land but absolutely require water to successfully reproduce, certain plants share this exact dual lifestyle.

Step 3: Detailed Explanation:

Bryophytes, an ancient plant group encompassing mosses, liverworts, and hornworts, primarily inhabit moist, shaded terrestrial environments.

However, their reproductive biology ties them inherently to water. They uniquely possess flagellated male gametes (sperm) that lack the protective shell of modern pollen.

These gametes absolutely require a continuous thin film of surface water to physically swim towards the female gamete (egg) safely lodged within the archegonium for successful fertilization. Because their sexual reproduction is entirely dependent on the presence of external environmental water, they perfectly mirror the biological lifestyle of amphibians.

While Pteridophytes (like ferns) also need water for fertilization, the specific, established title "amphibians of the plant kingdom" is historically and uniquely assigned to Bryophytes.

Gymnosperms and Angiosperms evolved sophisticated pollen tubes for dry fertilization, entirely bypassing the need for external water.

Step 4: Final Answer: The correct plant group is Bryophytes.

 Quick Tip

Bryophytes = Plant Amphibians.

They noticeably lack true complex vascular tissues (no true xylem or phloem) and strictly rely on an external film of water to transport their motile sperm for successful fertilization!

11. What is the main process by which nitrogen is returned to the atmosphere from the soil?

- (A) Nitrogen fixation
- (B) Ammonification
- (C) Denitrification
- (D) Nitrification

Correct Answer: (C) Denitrification

Solution:

Step 1: Understanding the Question: The question specifically asks for the biological process in the nitrogen cycle that operates in reverse to convert soil-bound nitrogen back into inert atmospheric nitrogen gas.

Step 2: Key Concept: The global nitrogen cycle involves several distinct, bacterially mediated steps: Fixation, Nitrification, Assimilation, Ammonification, and Denitrification.

Step 3: Detailed Explanation:

Let's systematically break down each cycle step listed in the options:

Nitrogen Fixation converts atmospheric nitrogen gas (N_2) into usable ammonia (NH_3), effectively bringing nitrogen out of the air and into the biological system.

Nitrification is a two-step oxidative process converting ammonia into nitrites (NO_2^-) and subsequently into nitrates (NO_3^-).

Ammonification organically breaks down complex nitrogen from dead decaying matter into

simple ammonia.

Denitrification, however, is the biological reduction of soil nitrates (NO_3^-) ultimately back into inert nitrogen gas (N_2) or nitrous oxide (N_2O).

This crucial process is carried out by specialized anaerobic bacteria (such as *Pseudomonas* and *Thiobacillus*) operating in oxygen-depleted conditions, like waterlogged soils, thereby completing the biogeochemical cycle by returning nitrogen to the atmosphere.

Step 4: Final Answer: The correct process is Denitrification.

 Quick Tip

The prefix 'De-' implies a reversal or removal process.

Denitrification actively reverses the soil fixation process, effectively releasing free nitrogen gas (N_2) safely back into the ambient air to close the cycle loop!

12. In the context of waste management, what does the term leachate refer to?

- (A) Gas released from decomposing waste
- (B) Liquid that drains or percolates through waste and carries dissolved substances
- (C) Solid residue left after waste incineration
- (D) Recycled organic compost material

Correct Answer: (B) Liquid that drains or percolates through waste and carries dissolved substances

Solution:

Step 1: Understanding the Question: The question reliably tests foundational terminology used in modern solid waste management, specifically requiring the exact definition of "leachate."

Step 2: Key Concept: Landfills naturally process different physical states of waste over time.

Gases escape upwards into the atmosphere, solid residues remain stationary, and liquids percolate downwards due to gravity.

Step 3: Detailed Explanation:

When rainwater, snowmelt, or any intrinsic moisture enters a landfill site, it slowly percolates downward through the compacted layers of solid waste.

As this liquid physically moves through the waste matrix, it dissolves, extracts, and actively carries various soluble, suspended, and miscible materials.

This complex chemical cocktail routinely includes dangerous heavy metals, volatile organic toxins, and microbial pathogens.

This highly contaminated and deeply foul-smelling liquid is professionally termed leachate.

If not properly collected, contained, and treated using impermeable landfill liners and drainage systems, leachate can catastrophically contaminate local groundwater aquifers and pristine soil. Comparatively, gas released from decomposing waste is called landfill gas (predominantly methane), and the solid residue from incineration is formally known as bottom ash or fly ash.

Step 4: Final Answer: Leachate precisely refers to the contaminated liquid that drains through waste and carries dissolved hazardous substances.

💡 Quick Tip

Think of how you make tea to remember the concept of Leachate!

Just like hot water "leaches" color and flavor out of a tea bag, infiltrating rainwater "leaches" toxic chemicals out of landfill waste, generating hazardous **leachate** liquid.

13. Which Indian state is most associated with the controversial practice of rat-hole mining?

- (A) Jharkhand
- (B) Meghalaya
- (C) Odisha
- (D) Chhattisgarh

Correct Answer: (B) Meghalaya

Solution:

Step 1: Understanding the Question: The objective here is to identify the specific Indian state prominently known for the hazardous and heavily criticized practice known as "rat-hole mining."

Step 2: Key Concept: Rat-hole mining involves digging extremely small, narrow, and structurally unsupported horizontal tunnels (often just 3 to 4 feet high) to manually extract coal. It is usually employed in geographical areas where the natural coal seams are exceedingly thin and difficult to reach.

Step 3: Detailed Explanation:

This dangerous mining practice is predominantly associated with the northeastern Indian state of Meghalaya, particularly throughout the coal-rich Jaintia Hills region.

Because the coal seams in Meghalaya are uniquely thin and awkwardly positioned, traditional large-scale open-cast or highly mechanized underground mining techniques are deemed economically unviable by operators.

Consequently, locals dangerously resort to manual rat-hole mining, crawling into these tiny unventilated tunnels.

It is highly controversial due to extreme safety hazards (the tunnels frequently flood or physically collapse, trapping miners) and severe environmental degradation (producing acid mine drainage that aggressively pollutes local rivers).

Due to these glaring safety and ecological concerns, the National Green Tribunal (NGT) effectively and legally banned this practice across Meghalaya in 2014.

Step 4: Final Answer: The correct state associated with rat-hole mining is Meghalaya.

 Quick Tip

Rat-hole mining is unique to Meghalaya due to its distinct geology featuring very thin coal seams.

Always remember that the National Green Tribunal (NGT) strictly banned this heavily criticized practice in 2014 owing to lethal mine accidents and devastating ecological destruction.

14. The Environment Protection Act of India was enacted in which year following the Bhopal Gas Tragedy?

- (A) 1982
- (B) 1984
- (C) 1986
- (D) 1991

Correct Answer: (C) 1986

Solution:

Step 1: Understanding the Question: We need to identify the exact legislative year the Environment (Protection) Act (EPA) was officially enacted by the Indian Parliament as a direct response to the Bhopal Gas Tragedy.

Step 2: Key Concept: The Bhopal Gas Tragedy of 1984 abruptly exposed severe flaws and loopholes in India's existing industrial and environmental safety regulations, urgently prompting massive legislative reform.

Step 3: Detailed Explanation:

On the tragic night of December 2 – 3, 1984, a devastating and uncontrolled leak of highly toxic methyl isocyanate (MIC) gas occurred at the Union Carbide pesticide plant in Bhopal, instantly resulting in thousands of painful deaths.

In direct administrative response to this unprecedented disaster, the Government of India mobilized to pass the Environment (Protection) Act under Article 253 of the Indian Constitution. The Act was officially enacted in 1986 to serve as a comprehensive "umbrella" environmental legislation.

It uniquely provided the central government with sweeping and broad regulatory powers to rigorously protect the environment, set emission standards, and directly regulate hazardous industries, effectively plugging the gaping regulatory holes left by the earlier Water Act (1974) and Air Act (1981).

Step 4: Final Answer: The Environment Protection Act was enacted in the year 1986.

💡 Quick Tip

Memorize the chronological timeline of major Indian Environmental Laws:
Water Act (1974) → Air Act (1981) → **Bhopal Tragedy Occurs (1984)** → **Environment Protection Act Enacted (1986)**.

15. Which heavy metal is most commonly associated with Itai-Itai disease?

- (A) Mercury
- (B) Lead
- (C) Cadmium
- (D) Arsenic

Correct Answer: (C) Cadmium

Solution:

Step 1: Understanding the Question: The question specifically asks us to confidently link a recognized toxic heavy metal to the occurrence of "Itai-Itai" disease in humans.

Step 2: Key Concept: Unregulated industrial pollution unfortunately often leads to the massive bioaccumulation of specific heavy metals, which then trigger explicitly recognized and named medical syndromes in human populations.

Step 3: Detailed Explanation:

The tragic medical term "Itai-Itai" directly translates to "it hurts, it hurts" or "ouch-ouch" in Japanese, graphically characterizing the severe, agonizing joint and spine bone pain continuously suffered by the victims.

The disease painfully emerged in the Jinzu River basin in Toyama Prefecture, Japan, during the early 20th century.

Irresponsible mining companies routinely dumped highly acidic wastewater heavily laden with toxic heavy metals directly into the local river system.

This contaminated river water was then widely used by farmers to artificially irrigate vast rice paddy fields.

Consequently, Cadmium heavily bioaccumulated in the growing rice crops over years.

Chronic consumption of this deeply cadmium-tainted rice tragically caused severe irreversible

renal failure and massive osteomalacia (severe softening of the bones), directly leading to the extreme pain and multiple bone fractures defining the disease.

In stark contrast, Mercury poisoning causes Minamata disease, and long-term Arsenic exposure causes Arsenicosis (commonly presenting as black foot disease).

Step 4: Final Answer: Cadmium is unambiguously the heavy metal strictly responsible for causing Itai-Itai disease.

 Quick Tip

Cadmium negatively targets the Bones!

Cadmium biochemically mimics essential calcium in the human body, aggressively replacing it in skeletal structures, which directly leads to dangerously weak, intensely painful, and easily fractured bones (**Itai-Itai** or "ouch-ouch" disease).