



UGC NET Environmental Science 25th June Shift 1

Q1. The general form of the Gaussian plume model formula for ground-level concentration C(x,y,0) from a continuous point source is given as :



As the distance downwind (x) increases, what generally happens to σy and σz ?

(a) They both increase.

(b)They both decrease.

(c) σy decreases and σz increases.

(d) σy increases and σz decreases.

Ans.(a)

Sol. The Gaussian plume model explains how pollutants spread in the atmosphere, using dispersion coefficients σ_{γ} and σz for horizontal and vertical dispersion.

Information Booster (Correct Answer Explanation):

- σ_{γ} (horizontal spread) and σ_z (vertical spread) represent how wide and tall the pollutant plume becomes.
- As the plume moves downwind, turbulent mixing with the surrounding air increases.
- This leads to increasing values of σ_{γ} and σ_{z} , meaning the plume spreads out more in both directions.
- The result is greater dilution of pollutants over distance, reducing concentration at any fixed point.

Additional Knowledge (Other Options Clarified):

- B. Both decrease Incorrect: Dispersion doesn't shrink with distance; instead, it expands due to turbulence.
- C. σ_{γ} decreases, σ_{z} increases Incorrect: While rates of increase may differ based on conditions, both typically grow with distance.
- Note: The rate of dispersion depends on atmospheric stability, which affects turbulence intensity.

Q2. Beyond Iodine and Cesium, which other radioactive element, a bone-seeker, was a significant release from Chernobyl?

(a) Strontium-90

(b) Carbon-14

(c) Cobalt-60

(d) Tritium

Ans.(a)

Sol. The Chernobyl disaster released several radioactive elements, including isotopes that mimic calcium and accumulate in human bones.

Information Booster (Correct Answer – a) Strontium-90):

- Strontium-90 is a radioactive bone-seeker, chemically similar to calcium.
- It accumulates in bones and bone marrow, posing long-term health risks like bone cancer and leukemia.
- It was a major health concern post-Chernobyl due to its mobility and persistence in the environment.





Additional Knowledge (Other Options):

- (b) Carbon-14: Naturally occurring and produced in small quantities during nuclear events, but not a major Chernobyl release or bone-seeker.
- (c) Cobalt-60: Used in medical and industrial applications, but not significantly released in Chernobyl.
- (d) Tritium: A radioactive form of hydrogen; doesn't accumulate in bones and wasn't a major concern in this disaster.

Q3. Which of the following statements incorrectly explains the role of salinity in a solar pond's operation?

(a) Salinity difference between layers prevents convection in the NCZ.

(b) The highest salinity is maintained in the LCZ to maximize density and heat storage capacity.

(c) The UCZ has the lowest salinity, influenced by evaporation and rainfall.

(d) A uniform salinity profile across all zones is crucial for stable, long-term heat collection.

Ans.(d)

Sol. Solar ponds utilize a salinity gradient to trap and store solar energy, preventing natural convection and enabling effective heat retention.

Information Booster (Correct Answer - d):

- (d) is incorrect because a uniform salinity profile would allow convection, causing the heat from lower layers to rise and escape.
- Stability in a solar pond relies on a salinity gradient—denser, saltier water at the bottom and fresher water at the top—to suppress convection.
- Without this gradient, the pond cannot function as an efficient thermal storage system.

Additional Knowledge (Other Options):

- (a) Correct: A salinity gradient in the NCZ (Non-Convective Zone) hinders vertical mixing by stabilizing the water layers.
- (b) Correct: The LCZ (Lower Convective Zone) has maximum salinity, giving it higher density and enabling heat storage at the bottom.
- (c) Correct: The UCZ (Upper Convective Zone) has low salinity, which can vary with rainfall and evaporation, but helps keep the gradient intact.

Q4. Which of the following describes the typical order of operations for solids handling in a wastewater treatment plant?

- (a) Thickening \rightarrow Digestion \rightarrow Dewatering \rightarrow Disposal
- (b) Dewatering \rightarrow Thickening \rightarrow Digestion \rightarrow Disposal
- (c) Digestion \rightarrow Dewatering \rightarrow Thickening \rightarrow Disposal
- (d) Disposal \rightarrow Thickening \rightarrow Digestion \rightarrow Dewatering

Ans.(a)

Sol. Solids handling in a wastewater treatment plant involves step-by-step processing to reduce volume, stabilize organic matter, and safely dispose of residual sludge.

Information Booster (Correct Answer – a):

• Thickening: Concentrates the sludge by removing excess water, reducing volume for further treatment.





- Digestion: Biologically stabilizes the thickened sludge, reducing pathogens and odor—often through anaerobic or aerobic processes.
- Dewatering: Removes additional water to create a semi-solid cake, making transport and disposal easier.
- Disposal: Final step where treated sludge is either landfilled, incinerated, or reused (e.g., in agriculture).

Additional Knowledge (Other Options):

- (b) Dewatering → Thickening → Digestion → Disposal: Illogical, as dewatering should follow digestion for optimal efficiency.
- (c) Digestion → Dewatering → Thickening → Disposal: Skipping thickening first leads to unnecessary energy use in digestion.
- (d) Disposal → Thickening → Digestion → Dewatering: Disposal before treatment is not feasible or compliant with regulations.

Q5. How does sound intensity (I) change with distance (r) from a point source in an open, free field?

(a) It is inversely proportional to r.

(b) It is directly proportional to r.

(c) It is directly proportional to r2.

(d) It is inversely proportional to r2.

Ans.(d)

Sol. Sound intensity measures the power of sound per unit area, and it varies with distance from the source in open, unobstructed environments.

Information Booster (Correct Answer - d):

- Sound from a point source spreads spherically in all directions.
- The energy spreads over an increasing surface area as distance increases.
- Surface area of a sphere = $4\pi r^2$, so intensity I $\propto 1/r^2$.
- This inverse square relationship means doubling the distance reduces intensity to one-fourth.

Additional Knowl<mark>edge (Other</mark> Op<mark>tions</mark>):

- (a) I \propto 1/r: Too gradual a decrease, doesn't match spherical spreading.
- (b) I \propto r: Incorrect—intensity would increase with distance, which is physically implausible.
- (c) I \propto r²: Opposite of the correct behavior; it suggests an unrealistic increase in intensity with distance.

Q6. Which of the following cloud types are primarily found in the stratosphere?

A.Cirrus
B.Mother of pearl
C.Cumulonimbus
D.Nacreous Clouds
Choose the correct answer from the options given below:
(a) A and B Only
(b) B and D Only
(c) C and D Only
(d) A, C and D Only





Ans.(b)

Sol. Clouds are classified based on their altitude and appearance, and while most clouds form in the troposphere, a few rare types like nacreous (mother-of-pearl) clouds are found in the stratosphere.

Information Booster

Here's why Mother of pearl (B) and Nacreous clouds (D) are the correct answers:

- Nacreous Clouds (d):
- Also known as polar stratospheric clouds, they form in the lower stratosphere (about 15–25 km altitude).
 - These clouds are most often seen in polar regions during winter, where the stratosphere becomes extremely cold.
 - Their iridescent colors give them a pearlescent appearance—hence the name.
 - Scientifically significant because they play a role in ozone depletion by supporting chemical reactions that break down ozone.
- Mother of pearl clouds (b):
 - This is another term for nacreous clouds, and thus the same explanations apply.
 - Visibly striking due to their shimmering colors, they are best viewed shortly after sunset or before sunrise.

Additional Knowledge

- Cirrus (a):
 - Formed at high altitudes (above 6,000 meters) but still within the troposphere.
 - They consist of ice crystals and are typically wispy and thin.
 - Though high up, they do not extend into the stratosphere.
- Cumulonimbus (c):
 - These are thunderstorm clouds that can span from low altitudes up to the tropopause, and occasionally brush the bottom of the stratosphere—but their primary formation is still in the troposphere.
 - Known for their vertical development and association with severe weather, including lightning, hail, and tornadoes.

Q7. Which of the following are considered fissile isotopes

A. Uranium-235

B.Thorium-232

C. Plutonium-239

D. Uranium-238

Choose the correct answer from the options given below:

- (a) A, B and C Only
- (b) B, C and D Only
- (c) A and C Only
- (d) B and D Only

Ans.(c)

Sol. Fissile isotopes are nuclear materials that can sustain a chain reaction of nuclear fission with low-energy (thermal) neutrons. They're crucial in nuclear reactors and atomic bombs.





Information Booster (Correct Answer: (c) A and C Only): Uranium-235 (U-235):

- Uranium-235 (U-235
- Naturally fissileUsed in nuclear reactors and weapons
- Supports fission with thermal neutrons Plutonium-239 (Pu-239):
- Fissile, man-made
- Produced from Uranium-238
- Used in reactors and nuclear weapons

Additional Knowledge (Incorrect Options):

- Thorium-232 (Th-232):
- Fertile, not fissile
- Converts into fissile U-233 after neutron absorption Uranium-238 (U-238):
- Fertile
- Captures neutrons to form Plutonium-239
- Cannot sustain fission with thermal neutrons



Q8. Which of the following represents the correct sequence of layers of a typical main-sequence star from its innermost to outermost regions?

A. Core, Convective Zone, Radiative Zone, Photosphere, Chromosphere, Corona

- B. Core, Radiative Zone, Convective Zone, Photosphere, Chromosphere, Corona
- C. Photosphere, Chromosphere, Corona, Convective Zone, Radiative Zone, Core

D. Core, Radiative Zone, Convective Zone, Corona, Chromosphere, Photosphere Choose the correct answer from the options given below:

- (a) A Only
- (b) B Only
- (c) C Only
- (d) D Only

Ans.(b)

Sol. A main-sequence star like the Sun has a structured set of internal and atmospheric layers arranged by function—energy production, energy transport, and radiation into space.

Information Booster (Correct Answer: (b) B Only):

Core – Center of nuclear fusion and energy production.

Radiative Zone – Energy slowly moves outward by radiation.

Convective Zone – Hot gases circulate, moving energy to the surface.

Photosphere – Visible "surface" layer emitting light.

Chromosphere – Reddish layer visible during eclipses.

Corona – Hot, outermost layer extending into space.

Additional Knowledge (Why Others Are Incorrect):

Option A – Convective and Radiative Zones are in the wrong order

Option C - Reversed order; goes from outer to inner layers

Option D – Incorrect atmospheric layer order (Photosphere should come before Chromosphere and Corona)





- **Q9.** The power available in the wind is directly proportional to which of the following?
- A. The square of the blade radius (r2).

B. The cube of the wind speed (v3).

C. The air density (ρ).

D. The number of blades on the turbine.

Choose the correct answer from the options given below:

- (a) A, B and C Only
- (b) A, C and D Only
- (c) B and D Only
- (d) A, B, C and D

Ans.(a)

Sol. Wind power is the kinetic energy captured from moving air and converted into usable electricity, and its availability depends on certain physical factors.

Information Booster (Correct Answer: (a) A, B and C Only):

- A. Square of Blade Radius (r²):
- Power \propto Swept area of the blades, which is πr^2 .
- Larger blades capture more wind energy.
- B. Cube of Wind Speed (v^3) :
- Power increases dramatically with wind speed.
- Small speed increases \rightarrow large power gains.
- C. Air Density (ρ):
- Denser air carries more energy.
- Power is directly proportional to air density.

Additional Knowledge (Incorrect Option):

D. Number of Blades:

- Affects efficiency and stability, not power directly.
- Power equation does not include number of blades.

Q10. Arrange the following macroscopic forms of coal based on their typical hydrogen content (decreasing order):

A. Vitrain

B. Durain

C. Lignite (overall)

D. Anthracite (overall)

Choose the correct sequence from the options given below:

(a) C, A, B, D

- (b) A, C, B, D
- (c) D, B, A, C
- (d) B, C, D, A

Ans.(a)

Sol. Coal exists in several macroscopic forms, each with unique physical and chemical characteristics, including varying hydrogen content.







Information Booster (Correct Answer: (a) C, A, B, D):

Lignite (C):

- Youngest form of coal.
- Contains the highest volatile matter and hydrogen content.
- Lowest carbon concentration compared to other coals. Vitrain (A):
- Glossy, brittle coal composed of plant tissue.
- Has relatively high hydrogen and volatile content among macerals.

Durain (B):

- Dull, compact form of coal.
- Lower hydrogen content than vitrain.

Anthracite (D):

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- Oldest and most carbon-rich coal.
- Highest carbon, but lowest hydrogen content.
- Hard, shiny, and used for high-efficiency heating.

Additional Knowledge (Why Others Are Incorrect):

Option (b): Places vitrain above lignite, but lignite generally has higher hydrogen.

Option (c): Starts with anthracite, which actually has lowest hydrogen content.

Option (d): Begins with durain and ends with vitrain—both misplaced hydrogen-wise.

