10TH EDITION

UGC

NET/SET/JRF

ENVIRONMENTAL SCIENCE

(PAPER-II)



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P R E F A C E

Environmental sciences is an interdisciplinary field that bridges the natural sciences, social sciences, and humanities, focusing on understanding the complex interactions between humans and the environment. This book is designed specifically for UGC NET aspirants, offering a comprehensive resource to master the knowledge required for the examination through extensive practice with previous years' questions.

Preparing for the UGC NET exam is a significant milestone for aspirants aiming to secure a position in academia or research. All subjects included in the UGC-NET (JRF) exam share common UGC-NET Paper 1. Paper 2 consists of 100 multiple-choice questions, each carrying 2 marks. The total marks for Paper 2 are 200.

This book includes over 2000 questions, featuring previous years' questions from 2015 to 2026, along with detailed solutions. These questions cover all the crucial areas tested in the UGC NET Environmental Sciences exam, providing a thorough preparation tool for students. By working through these questions and their explanations, students will gain a deeper understanding of key concepts and be better equipped to tackle the exam with confidence.

This book is useful for SET, NET- JRF exam, PhD admission and many more competitive exams.

This book is designed to not only help you succeed in the UGC NET examination but also to deepen your understanding of environmental science. By working through these questions and their explanations, you will build a solid foundation in the subject and gain the confidence needed to excel in the exam.

Wishing you all the best in your preparations and success in your UGC NET journey.

UGC NET Environmental Science Exam Pattern:

UGC NET exam comprises two papers- Paper 1 and 2. As per the prescribed UGC NET Environmental Science exam pattern, both papers contain multiple-choice questions (MCQs). Candidates need to complete both papers in a single duration of three hours. Have a look at the detailed UGC NET exam pattern below.

- The UGC NET Exam is conducted in a Computer-Based Test (CBT) format, allowing candidates to answer questions using a digital interface.
- Questions are available in both Hindi and English, except for the "English Language" section.

Subject	No. of Questions (MCQ)	Maximum Marks	Negative marks
Paper-I	50 (Compulsory)	100 Marks	0
Paper-II	100	200 Marks	0
Total	150	300 Marks	

CUT OFF

Year	Category	UR	OBC (NCL)	EWS	SC	ST	PWD
2025 JUNE	Assistant Professor	156	144	144	138	136	126
	JRF & Assistant Professor	174	164	166	158	156	138
2025 JAN	Assistant Professor	174	160	160	150	146	142
	JRF & Assistant Professor	196	188	190	174	172	162
2024 AUG	Assistant Professor	160	146	148	138	136	124
	JRF & Assistant Professor	182	170	172	160	160	130
2023 DEC	Assistant Professor	154	142	142	136	130	128
	JRF & Assistant Professor	174	164	164	154	152	142
2023 JUNE	Assistant Professor	168	154	156	146	140	138
	JRF & Assistant Professor	186	174	180	162	158	152
2022 DEC	Assistant Professor	170	156	156	146	140	148
	JRF & Assistant Professor	196	178	190	168	162	160
2022 JUNE	Assistant Professor	188	176	174	164	158	158
	JRF & Assistant Professor	206	194	194	182	176	174

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Unit-III: Environmental Biology

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Unit-VII: Solid and Hazardous Waste Management

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NUMBER OF QUESTIONS ASKED IN UGC NET - ENVIRONMENTAL SCIENCE (DECEMBER 2015 to JUNE 2026)

UNIT-1		2015	2016	2017		2018	2019		2020	2021	2022	2023	2024		2025		2026	
FUNDAMENTALS OF ENVIRONMENTAL SCIENCES		DEC	JUL	JAN	NOV	JUL	JUN	DEC	JUN	JUN	SEP	MAR	JUN	SEP	JAN	JUNE	JAN	JUNE
1	Definition, Principles and Scope of Environmental Science	-	2	-	1	1	-	1	1	-	-	-	-	-	1	-	-	-
2	Structure and Composition of Atmosphere, Hydrosphere, Lithosphere and Biosphere.	4	5	4	2	2	-	3	1	-	3	2	-	2	2	2	1	-
3	Laws of Thermodynamics, Heat Transfer Processes, Mass and Energy Transfer Across Various Interfaces, Material Balance.	1	-	-	2	2	-	1	1	2	1	-	2	1	-	1	-	1
4	Meteorological Parameters -	6	3	6	5	4	5	7	6	3	3	7	7	3	5	2	4	5
5	Interaction between Earth, Man and Environment. Biogeographic Provinces of the World and Agro-climatic Zones of India. Concept of Sustainable Development.	1	2	-	2	1	1	-	1	-	2	1	1	1	1	2	-	-
6	Natural Resources and their Assessment	4	2	2	2	3	3	-	-	-	-	-	1	1	1	2	-	-
7	Environmental Education and Awareness. Environmental Ethics.	2	1	-	1	-	-	1	-	-	1	1	-	-	1	-	-	-

CHAPTER-1 FUNDAMENTALS OF ENVIRONMENTAL SCIENCES

Unit 1.1 : Definition, Principles and Scope of Environmental Science

Previous Year Exam Questions

(JULY-2016)

1. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):

Assertion (A): At a constant temperature, the solubility of ammonia in water increases with decrease in pH.

Reason (R): The solubility of all gases increase with decrease in pH.

Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).

(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).

(C) (A) is true, but (R) is false.

(D) (A) is false, but (R) is true.

(JULY-2016)

2. For public use, Survey of India publishes topographical maps on $1:50{,}000$ scale. These maps use

(A) UTM projection and WGS 84 datum

(B) Polyconic projection and WGS84 datum

(C) UTM projection and Modified Mount Everest datum

(D) Polyconic projection and Modified Mount Everest datum

(NOV-2017)

3. What was the theme for the International Ozone Day (year 2017)?

(A) 'Caring for all life under the Sun'

(B) 'Ozone ; All there is between you and UV"

(C) 'Ozone and Climate : Restored by a World United"

(D) ' 30 years of healing Ozone Together'

(JULY-2018)

4. World Biodiversity day is celebrated every year on:

(A) March 22 (B) May 22

(C) July 22 (D) November 22

(DEC-2019)

5. Match the celebration of days related to environment with their corresponding dates:

List-I (Days)	List-II (Dates)
(a) Earth Day	(i) 2nd February
(b) International Ozone Day	(ii) 16th September
(c) International Biodiversity Day	(iii) 22nd April
(d) Wetland Day	(iv) 22nd May

Choose the correct answer from the options given below:

(A) a-ii, b-iii, c-i, d-iv (B) a-iv, b-ii, c-iii, d-i

(C) a-iii, b-ii, c-i, d-iv (D) a-iii, b-ii, c-iv, d-i

(JUNE-2020)

6. Match List-I (Environmentally significant Days) with List-II (Dates).

List-I (Environmentally significant Days)	List-II (Dates)
(a) World Ozone Day	(i) 16 September
(b) World Habitat Day	(ii) 21 March
(c) World Forest Day	(iii) 5 October
(d) World Water Day	(iv) 22 March

Choose the correct answer from the options given below:

(A) a-iv, b-iii, c-i, d-ii (B) a-ii, b-i, c-iv, d-iii

(C) a-i, b-iii, c-ii, d-iv (D) a-iii, b-i, c-iv, d-ii

(JAN-2025)

7. Global atmospheric circulation tends to produce arid areas at :

(A) 30° Latitude (B) 10° Latitude

(C) 60° Latitude (D) The equator

Answer Key						
1	2	3	4	5	6	7
C	A	A	B	D	C	A

EXPLANATION

1. Correct Answer (C): Assertion (A) is correct because ammonia (NH_3) is a weak base, and its solubility in water increases as the pH decreases (becomes more acidic). However, Reason (R) is incorrect because not all gases behave this way; for some gases, their solubility may decrease with decreasing pH.

2. Correct Answer (A): Topographical maps published by the Survey of India at a scale of 1:50,000 provide detailed geographical information using the Universal Transverse Mercator (UTM) projection and the World Geodetic System 1984 (WGS 84) datum. UTM projection divides the Earth's surface into a series of zones to minimize distortion, making it ideal for accurate mapping of large regions. WGS 84 datum ensures compatibility with GPS coordinates, facilitating precise navigation and geographic referencing.

3. **Correct Answer (A):** The theme 'Caring for all life under the Sun' was selected for International Ozone Day in 2017 to highlight the importance of ozone protection and its impact on all forms of life on Earth (A).

4. **Correct Answer (B):** World Biodiversity Day, also known as the International Day for Biological Diversity, is celebrated on May 22nd every year. It aims to increase understanding and awareness of biodiversity issues globally.

5. **Correct Answer (D): Earth Day - 22nd April**: Earth Day is an annual event dedicated to environmental protection, first celebrated in 1970. **International Ozone Day - 16th September**: This day commemorates the signing of the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987. **International Biodiversity Day - 22nd May**: This day, established by the UN, promotes awareness and action on biodiversity issues. **Wetland Day - 2nd February**: World Wetlands Day marks the adoption of the Ramsar Convention on Wetlands in 1971.

6. **Correct Answer (C):** Environmentally significant days raise awareness about critical environmental issues. World Ozone Day (a-i) on 16 September promotes actions to protect the ozone layer. World Habitat Day (b-iii) on 5 October emphasizes the importance of sustainable urban development. World Forest Day (c-ii) on 21 March highlights the importance of forests for biodiversity and climate regulation. World Water Day (d-iv) on 22 March focuses on the importance of freshwater and advocates for sustainable management of water resources. These observances encourage global participation in environmental protection and sustainability efforts.

7. **Correct Answer (A):**
At **30° latitude**, both in the Northern and Southern Hemispheres, the **Hadley cell** circulation causes air to descend, creating high-pressure areas. This leads to dry, arid conditions and the formation of deserts, such as the Sahara and the Arabian Desert. The air at this latitude is dry because it has already lost moisture as it rose at the equator.
In contrast, at the **equator (0° latitude)**, rising air creates **rainforests**, and at **60° latitude**, moist, cooler air leads to wetter climates, not arid conditions. Thus, **30° latitude** is where major deserts are found.

Unit 1.2 : Structure and Composition of Atmosphere, Hydrosphere, Lithosphere and Biosphere.

Previous Year Exam Questions

(DEC-2015)

1. **The source of Stratospheric NO_4 is:**
(A) Atmospheric N_2 (B) Tropospheric N_2O
(C) Tropospheric NO (D) Tropospheric NO_2

(DEC-2015)

2. **In troposphere, which of the following processes does not generate hydroxyl radical?**
(A) $O(D) + H_2O$ (B) $O(P) + H_2O$
(C) $HCHO + hv$ (D) $HNO_2 + hv$

(DEC-2015)

3. **The Wavelengths that are most important in the context of stratospheric ozone depletion are:**
(A) $280 - 320\ nm$ (B) $400 - 700\ nm$
(C) $700 - 900\ nm$ (D) $> 900\ nm$

(DEC-2015)

4. **A common features of the synoptic and mesoscale motions in the atmosphere is that their:**
(A) Vertical motion component is more in magnitude than the horizontal wind component.
(B) Vertical motion component is roughly comparable to horizontal wind component.
(C) Vertical motion component is an order of magnitude smaller than the horizontal wind component.
(D) Properties can be studied by conventional synoptic networks.

(JULY-2016)

5. **Photoionization of gas molecules maintains the temperature profile of which atmospheric layer?**
(A) Troposphere (B) Stratosphere
(C) Mesosphere (D) Thermosphere

(JULY-2016)

6. **Which of the following is a major photochemical oxidant?**
(A) PAN
(B) Ozone
(C) Aldehydes
(D) Peroxybenzoyl nitrates ($PBzN$)

(JULY-2016)

7. **Given below are two statements. One labeled as Assertion (A) and the other labeled as Reason (R):**
Assertion (A): Temperature in the stratosphere increases with increase in altitude.
Reason (R): Photodissociation of O_2 in the stratosphere makes the lapse rate positive.
Choose the correct answer:
(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.

Choose the correct answer from the options given below:

(A) A, B, C, D, E (B) B, A, C, D, E
(C) B, A, D, C, E (D) B, A, E, D, C

(JUNE 2025)

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

A. Cirrus clouds
B. Cumulonimbus clouds
C. Mother of Pearl clouds
D. Nacreous clouds
E. Noctilucent clouds

Choose the correct answer from the options given below:

(A) A, C and D Only (B) B, D and E Only
(C) C, D and E Only (D) A, D and E Only

(JAN 2026)

33. Arrange the following layers of the atmosphere in terms of decreasing mean free paths of molecules /ions existing there.

A. Troposphere B. Stratosphere
C. Mcsosphere D. Thermosphere

Choose the correct answer from the options given below:

(A) A, B, C, D (B) B, C, D, A
(C) C, D, A, B (D) D. C. B. A

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
B	B	A	C	D	B	C	A	D	D
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
D	C	D	A	A	D	A	C	C	B
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
A	C	B	B	C	B	D	D	D	D
31	**32**	**33**							
C	A	D							

EXPLANATION

1. Correct Answer (B): The primary source of stratospheric NO_4 (nitrogen tetroxide) is the photodissociation of nitrous oxide (N_2O) from the troposphere. Nitrous oxide, a long-lived greenhouse gas, rises from the troposphere into the stratosphere, where it is broken down by ultraviolet radiation. This photodissociation process leads to the formation of various nitrogen oxides, including nitric oxide (NO) and nitrogen dioxide (N_2O), which can further react to form NO_4. These nitrogen oxides play a crucial role in stratospheric chemistry, particularly in ozone layer depletion

2 Correct Answer (B): In the troposphere, the hydroxyl radical (OH) is generated through several processes, but not from the reaction O(P) + H_2O. The primary pathways include the reaction of excited oxygen atoms O(1D) with water vapor (H_2O), photolysis of formaldehyde (HCHO) by sunlight, and the photolysis of nitrous acid (HNO_2). The hydroxyl radical is a key reactive species in atmospheric chemistry, acting as a "detergent" by breaking down pollutants and greenhouse gases. Its formation is essential for maintaining the chemical balance of the atmosphere.

3. Correct Answer (A): Stratospheric ozone depletion is primarily driven by ultraviolet (UV) radiation, particularly UV-B radiation (280-320 nm). This range of wavelengths is most effective in breaking apart ozone (O_3) molecules in the stratosphere. When UV-B radiation interacts with ozone molecules, it can split them into oxygen molecules (O_2) and free oxygen atoms (O). This depletion of ozone is concerning because the ozone layer in the stratosphere helps shield life on Earth from harmful UV radiation from the sun, which can cause skin cancer, cataracts, and other health problems in humans, as well as damage ecosystems.

4. Correct Answer (C): Synoptic-scale and mesoscale atmospheric motions refer to different scales of weather phenomena, each characterized by distinct spatial and temporal characteristics. Synoptic-scale motions cover large geographic areas (hundreds to thousands of kilometers) and include weather systems like high and low-pressure systems. These systems are associated with horizontal wind patterns that dominate over vertical motions, which are generally weaker in magnitude.

Mesoscale motions are smaller-scale phenomena (tens to hundreds of kilometers) such as thunderstorms, sea breezes, and mountain-valley winds. Despite their smaller spatial extent, mesoscale systems also exhibit predominantly horizontal wind components, with vertical motions typically occurring on a smaller scale and with lower intensity compared to horizontal wind speeds. Understanding the interaction between horizontal and vertical atmospheric motions is crucial for meteorological forecasting, climate modeling, and understanding weather patterns and dynamics.

5. Correct Answer (D): The thermosphere is the fourth layer of the Earth's atmosphere, located above the mesosphere and below the exosphere. In this layer, solar radiation is absorbed by gas molecules, causing them to ionize, a process known as photoionization. This absorption of energy leads to a significant increase in temperature with altitude, making the thermosphere the hottest layer of the atmosphere.

The high energy ultraviolet (UV) and X-ray radiation from the Sun is primarily responsible for the ionization of gas molecules, which in turn maintains the temperature profile of the thermosphere.

6. Correct Answer (B): Photochemical oxidants are air pollutants formed through chemical reactions involving sunlight, nitrogen oxides (NOx), and volatile organic compounds (VOCs). Ozone (B) is a major photochemical oxidant formed in the lower atmosphere (troposphere) by the interaction of sunlight with NOx and VOCs. Ozone contributes significantly to the formation of smog and is harmful to human health and vegetation.

7. Correct Answer (C): In the stratosphere, temperature typically increases with altitude due to the absorption of solar radiation by ozone molecules. This absorption heats the stratosphere, creating a positive lapse rate where temperature rises with altitude. Photodissociation of oxygen molecules (O2) by solar ultraviolet (UV) radiation also contributes to stratospheric heating by releasing energy during recombination processes. This thermal structure plays a crucial role in atmospheric circulation, climate patterns, and the formation of the ozone layer

8. Correct Answer (A): Mixing height refers to the vertical extent within the atmosphere where pollutants can disperse and mix effectively. During night-time, especially under stable atmospheric conditions, mixing heights are generally restricted to lower levels close to the ground. This limitation occurs because stable air prevents vertical mixing, trapping pollutants near the surface and reducing their dispersion. Typically, mixing heights during the night are confined to a few hundred meters, emphasizing the challenges in pollutant dispersion and air quality management under such conditions.

9. Correct Answer (D): The ionic species $O^+, {O_2}^+$and ${N_2}^+$ are generally found in the heterosphere. The heterosphere is the upper part of the Earth's atmosphere where gases are stratified into layers based on their molecular weight. In this region, lighter gases such as hydrogen (H), helium (He), and atomic oxygen (O) dominate the uppermost layers, while heavier gases like nitrogen (N) and oxygen (O2) are found in lower layers.

10. Correct Answer (D): Aerosols are tiny particles suspended in the atmosphere. They can be classified based on their sources:

(a) Primary natural aerosol → (iv) Soil dust

(b) Secondary natural aerosol → (i) Organic matter from biogenic gases

(c) Primary anthropogenic aerosol → (ii) Soot from biomass burning

(d) Secondary anthropogenic aerosol → (iii) Sulphate aerosol from power plant SO_2 emissions.

11. Correct Answer (D): The settling velocity of particles in the air is influenced by their size, shape, and density. For spherical aerosol particles with a diameter d much smaller than 30 µm and with a density significantly greater than that of air, their settling velocity (Vs) can be described by Stokes' law:

$V_s = \frac{2}{9} \frac{(\rho_p - \rho_a) g d^2}{\eta}$

where:

- ρ_p is the density of the particle,
- ρ_a is the density of the air,
- g is the acceleration due to gravity,
- η is the dynamic viscosity of the air.

According to this equation, the settling velocity is directly proportional to the square of the particle diameter (d^2). Hence, the correct answer is (D) $\propto d^2$

12. Correct Answer (C): Sulphate aerosols are fine particles that are introduced into the atmosphere from both natural and anthropogenic sources, such as volcanic eruptions and fossil fuel combustion. These particles have a high albedo, meaning they can reflect incoming solar radiation back into space. This reflection reduces the amount of solar energy that reaches the Earth's surface, leading to a cooling effect on the global climate. This phenomenon is known as "aerosol radiative forcing."

13. Correct Answer (D): Wet deposition is critical as a global sink process for aerosols, involving the removal of particles from the atmosphere through precipitation. This process includes rain, snow, and hail, which effectively scavenge aerosols and pollutants from the air, depositing them onto land or water bodies. Wet deposition plays a significant role in cleansing the atmosphere of particulate matter and pollutants, contributing to air quality improvement and environmental health.

14. Correct Answer (A): Assertion (A) states that the evaporation of surface water is reduced due to black carbon in the atmosphere. This assertion is correct because black carbon particles can absorb sunlight, leading to localized warming and altering local temperature gradients, which can affect evaporation rates. Reason (R) asserts that the presence of aerosols containing black carbon causes a dimming effect, which is also correct. Aerosols, including black

carbon, can reflect sunlight back into space, reducing the amount of solar radiation reaching the Earth's surface and potentially reducing evaporation rates.

15. **Correct Answer (A):** Ozone in the Earth's atmosphere absorbs and emits radiation primarily around the wavelength of 9.6 micrometers. This absorption affects the energy balance and climate regulation processes in the atmosphere.

16. **Correct Answer (D):** The basic nature of the lithosphere arises from elements such as Na (sodium), K (potassium), Ca (calcium), and Mg (magnesium), which contribute to the formation of minerals like feldspars, micas, calcite, olivine, and pyroxene. Silicon (Si) is a fundamental component of the lithosphere, forming the basis of silicate minerals, which are abundant in the Earth's crust. However, the basic nature of the lithosphere does not arise specifically from Si alone, but from its combination with other elements to form these silicate minerals.

17. **Correct Answer (A):** Upwelling in temperate lakes occurs primarily during autumn and spring seasons. It involves the vertical movement of nutrient-rich water from deeper layers to the lake's surface driven by wind-induced processes. This upwelling replenishes essential nutrients like phosphorus and nitrogen, which are crucial for supporting biological productivity and sustaining aquatic ecosystems throughout changing seasons.

18. **Correct Answer (C):** This statement is incorrect. The lowest temperatures are actually found at the mesopause, the boundary between the mesosphere and the thermosphere. The tropopause, the boundary between the troposphere and the stratosphere, marks the point where temperature stops decreasing with altitude and starts increasing in the stratosphere.

19. **Correct Answer (C):** The atmosphere is divided into several layers based on temperature and composition. The layer closest to the Earth's surface where 90% of the total atmospheric mass is confined is the **troposphere**. The troposphere extends up to approximately 8-15 kilometers (about 5-9 miles) above sea level on average, though it can reach up to about 20 kilometers (12 miles) at the equator and lower latitudes.

20. **Correct Answer (B):** Gases removed by oxidation include CO (carbon monoxide), CH4 (methane), and HCFCs (hydrochlorofluorocarbons). These gases undergo chemical reactions in the atmosphere where they react with oxygen (O2) to form oxidized products or compounds that are less harmful or inert, thereby reducing their concentration in the atmosphere.

21. **Correct Answer (A):** The tropopause acts as a 'lid' limiting convection and transport from the troposphere to higher atmospheric layers. This is because the atmosphere becomes stable at the tropopause height and above, preventing the vertical movement of air masses. This stability is due to the temperature inversion or isothermal conditions found at the tropopause, where the temperature stops decreasing with altitude and may even increase. This barrier plays a crucial role in weather patterns and the distribution of atmospheric pollutants, maintaining distinct layers within the atmosphere.

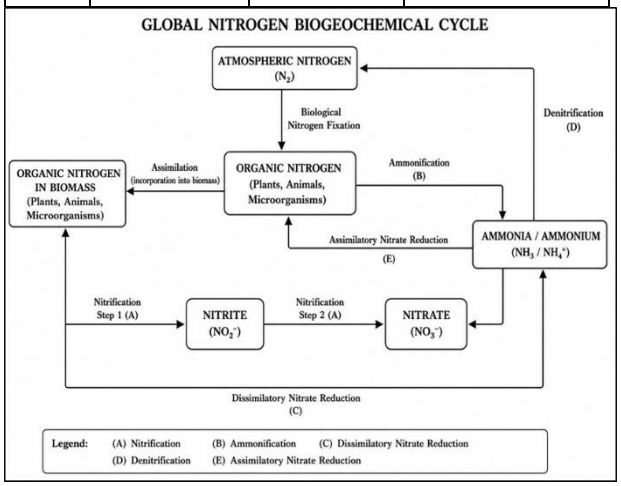
22. **Correct Answer (C):** Statement I correctly identifies halons as bromine-containing substances involved in ozone depletion. Statement II is false as global efforts replaced CFCs (Chlorofluorocarbons), not halons, with safer alternatives like HCFCs and HFCs to protect the ozone layer, reflecting misconceptions about chemical substances and environmental impacts.

23. **Correct Answer (B):**
    (a) Exosphere: High temperatures due to solar radiation.
    (b) Stratosphere: Ozone formation.
    (c) Troposphere: Air movements and cloud formation.
    (d) Thermosphere: Propagation of radio waves.

24. **Correct Answer (B):** Jet streams are fast-flowing, narrow air currents found in the upper atmosphere (troposphere) around the Earth's polar regions and subtropical regions. They are driven by temperature gradients between air masses and play a crucial role in weather patterns and atmospheric circulation. Jet streams are important for aviation, as they can significantly affect flight times and fuel efficiency.

25. **Correct Answer (C):** In the stratosphere:
- UV-C: Breaks down O_2 molecules.
- 1% decrease in O_3: Leads to a 2% increase in UV-B at ground level.
- UV-A: Is biologically the least harmful.
- UV-B: Also helps in ozone dissociation.Chapman mechanism: Describes both the formation and destruction of ozone, maintaining a balance in the stratosphere.

			nitrogen to the atmosphere.
E	**Assimilatory nitrate reduction**	(NO_3^- → NH_4^+ → Organic N)	Reduction of nitrate to ammonium followed by incorporation into organic nitrogen compounds/biomass.



39. Correct Answer (C): Here, **BC (D)** is the deepest among the given horizons because it is a transition between the **B and C horizons** and is closest to the parent-material horizon. Above it comes **BE (E)**, a transitional horizon between B and E in which B-horizon characteristics dominate. Next is **EB (C)**, a transition between E and B in which E-horizon characteristics dominate. Above the mineral horizons are the **organic O horizons**. **Oa (A)** consists of highly decomposed organic material, while **Oe (B)** consists of relatively less decomposed organic material and therefore occurs above Oa.

40. Correct Answer (B): The **pE–pH diagram** describes the stability/predominance of different nitrogen species according to oxidation–reduction conditions and acidity/alkalinity.

Nitrogen Species vs. Redox Conditions		
Species	**Oxidation state of N**	**General redox condition**
NO_3^-	+5	Strongly oxidizing / high pE
NO_2^-	+3	**Intermediate redox conditions**
N_2	0	Intermediate/reducing conditions
NH_4^+	−3	Strongly reducing conditions

At **pE 0–4**, conditions are neither strongly oxidizing nor strongly reducing. Under **alkaline pH (8–14)**, **nitrite (NO_2^-)** occupies the relevant stability field.

Unit 2.5: Toxic Chemicals: Pesticides and their Classification and Effects. Biochemical Aspects of Heavy Metals (HG, CD, PB, CR) and Metalloids (AS, SE). CO, O3, PAN, VOC and POP. Carcinogens in the Air.

Previous Year Exam Questions

(DEC-2015)

1. Which of the following statement is incorrect?
(A) Chromium (VI) is highly toxic
(B) Methyl mercury is most toxic mercury species
(C) Arsenic (III) is more toxic than arsenic (V)
(D) Cadmium is a criteria pollutant

(DEC-2015)

2. Insect pests can be controlled by the use of:
(a) Insecticide
(b) Pheromones
(c) Juvenile Hormones
(d) Nitrophosphate
Choose the correct answer:
(A) (a) only (B) (a) and (b) only
(C) (a), (b) and (c) only (D) (a),(b),(c) and (d)

(JULY-2016)

3. Match the List-I and List-II. Identify the correct answer from the codes given below:

List-I (Pesticides)	**List-II (Purpose)**
(a) Malathion	(i) Molluscicide
(b) Metaldehyde	(ii) Fungicide
(c) Diethyl Tolumide (DEET)	(iii) Insecticide
(d) Chloroneb	(iv) Insect repellant

Codes:
(A) a-iv, b-ii, c-i, d-iii (B) a-i, b-iii, c-ii, d-iv
(C) a-ii, b-iv, c-iii, d-i (D) a-iii, b-i, c-iv, d-ii

(JAN-2017)

4. Which of the following substances is generally not considered toxic?
(A) Carbonic acid (B) Carbon monoxide
(C) Acetaldehyde (D) Benzene

(JAN-2017)

5. Among the following insecticides, which one is relatively more soluble in water?`
(A) Aldicarb (B) Carbaryl
(C) Malathion (D) Aldrin

CHAPTER-3 ENVIRONMENTAL BIOLOGY

Unit 3.1 : Ecology as an Inter-disciplinary Science. Origin of Life and Speciation. Human Ecology and Settlement.

Previous Year Exam Questions

(DEC 2015)

1. Speciation means:
(A) Natural process of extinction of different species
(B) Artificial process of extinction of different species
(C) One species splits into two or more different species naturally
(D) Characterisation of different species

(DEC 2015)

2. Best spatial configuration for designing a core natural area is:
(A) Circular (B) Rectangular
(C) Square (D) Triangle

(JULY 2016)

3. Sclerophyllous leaves are the characteristic features of
(A) Chaparral Vegetation
(B) Grassland Vegetation
(C) Tropical Vegetation
(D) Alpine Vegetation

(NOV 2017)

4. The organism likely to be most similar to the first life form that evolved on the earth is:
(A) Blue - green algae
(B) Methane producing bacteria
(C) Protozoan
(D) Red algae

(JULY 2018)

5. Reproductive isolation of populations leads to:
(A) infertility
(B) population explosion
(C) speciation
(D) population decline

(JULY 2018)

6. In landscape ecological studies, the term landscape process includes:
(a) The exchange of materials and energy
(b) Exchange or movement of organisms
(c) Patch, matrix and corridor
(d) Porosity
Choose the correct code:
(A) (a) only (B) (a) and (b) only
(C) (a),(b) and (c) only (D) (a),(b),(c) and (d)

(JUNE 2019)

7. Match List-I (Property) with List-II (Ecological Level):

List-I (Property)	List-II (Ecological Level)
(a) Fragmentation	(i) Community
(b) Assembly	(ii) Ecosystem
(c) Integrity	(iii) Population
(d) Dispersion	(iv) Landscape

Choose the correct answer from the options given below:
(A) a-ii, b-iii, c-iv, d-i (B) a-iii, b-i, c-ii, d-iv
(C) a-iv, b-i, c-ii, d-iii (D) a-i, b-iii, c-ii, d-iv

(DEC-2019)

8. In ecological sampling, Importance Value Index refers to sum of which of the following?
(a) Relative density
(b) Relative frequency
(c) Relative abundance
(d) Relative dominance
Choose the correct answer from the options given below:
(A) (a),(b) and (c) (B) (d),(c) and (d)
(C) (b),(c) and (a) (D) (a),(b) and (d)

(JUNE-2019)

9. The first state to be declared as an organic state of the country is:
(A) Sikkim (B) Uttarakhand
(C) Himachal Pradesh (D) Kerala

(MAR-2023)

10. Match List-I with List-II:

List-I (Term)	T-List-II (Definition)
(a) Sympatric speciation	I. The process by which organisms adapt to changed environmental conditions to form new species in a relatively short period
(b) Parapatric speciation	II. The process of differentiation and acquiring reproductive isolation within the same geographical area
(c) Adaptive speciation	III. Population evolving in different geographical regions due to isolation
(d) Allopatric speciation	IV. The process of speciation which occurs between adjacent populations within a broadly continuous habitat

Codes:
(A) a-IV, b-II, c-III, d-I (B) a-II, b-IV, c-I, d-III
(C) a-I, b-II, c-III, d-IV (D) a-III, b-I, c-II, d-IV

(C) Much of Earth's iron has escaped as a result of extraterrestrial impacts.
(D) Iron is rare in Earth.

(JAN-2025)

20. A species originates:
(A) Only from natural selection
(B) Only from reproductive isolation
(C) From natural selection when it is coupled with reproductive isolation
(D) Neither from natural selection nor from reproductive isolation

Comprehension:
Read the following passage and answer the questions below:

The first phototrophs were anoxygenic and likely used H_2S as electron donor for CO_2 fixation, generating elemental sulfur (S^o) as a waste product. How could the first phototrophs have evolved at a time when life existed mostly near hydrothermal systems? A clue came from the recent discovery of anoxygenic phototrophs living at hydrothermal vents in the complete darkness of the deep ocean. These phototrophs actually carry out photosynthesis using infrared radiation generated by the heat of hydrothermal vents. Likewise, the first photosynthetic organisms likely lived in the dark, at hydrothermal vents where H_2S and infrared radiation were abundant. Diversification of anoxygenic phototrophs led to species that were able to use a range of electron donors including Fe^{2+}, which was abundant throughout Earth's early oceans. The ability to use Fe^{2+} as an electron donor likely allowed early phototrophs to escape from hydrothermal systems and colonize shallow regions of Earth's early oceans where light was abundant but where overlying water still provided protection from UV radiation. The ability to use solar radiation as an energy source allowed phototrophs to diversify extensively. By 2.5-3.3 bya, the cyanobacterial lineage evolved a photosystem capable of oxygenic photosynthesis in which H_2O supplanted H_2S as the reductant for CO_2, thereby generating O_2 as a waste product. About a billion years later, eukaryotic oxygen phototrophs appeared and can be seen in the microfossil record.

(JAN-2025)

21. Which of the following chemical species played a crucial role in the early phototrophs' colonization in the shallow waters of Earth's early oceans?
(A) H_2O (B) O_2
(C) Fe^{2+} (D) CO_2

(JAN-2025)

22. Identify the most probable time when the ability to use water for photosynthesis developed in the organisms.
(A) 3.8 billion years ago
(B) 3 billion years ago
(C) 4 billion years ago
(D) 4.3 billion years ago

(JAN-2025)

23. The first photosynthetic organisms likely released:
(A) S^o (B) H_2S
(C) CO_2 (D) O_2

(JAN-2025)

24. The first phototrophs used which of the following types of radiations for photosynthesis?
(A) Ultraviolet (B) Violet
(C) Infrared (D) Yellow

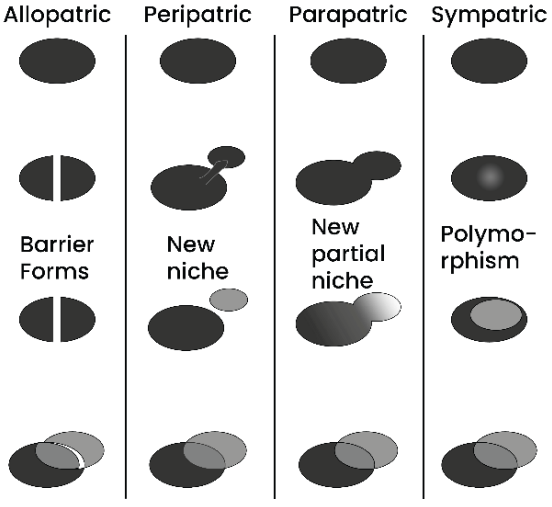
(JAN-2025)

25. The early photosynthetic organisms likely existed in:
(A) Surface waters
(B) Shallow regions of oceans
(C) Layers of oceans where visible light was abundant but UV light was absent
(D) Deep in the oceans at specific places in ocean bottoms

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(C)	(A)	(A)	(B)	(C)	(B)	(C)	(D)	(A)	(B)
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
(A)	(B)	(C)	(C)	(C)	(B)	(C)	(D)	(A)	(C)
21	**22**	**23**	**24**	**25**					
(C)	(B)	(A)	(C)	(B)					

EXPLANATION

1. Correct Answer (C): Speciation is the evolutionary process where populations of a single species evolve into distinct species through mechanisms like geographic and reproductive isolation. Genetic differences accumulate, creating new species with unique traits. This process drives biodiversity and adaptation to specific environments.



2. Correct Answer (A): A circular spatial configuration is often considered ideal for designing a core natural area, as it maximizes the area that is relatively free from edge effects and provides a more natural habitat for species. Circular designs minimize the amount of edge habitat, which can be more vulnerable to human disturbance and invasive species.

3. Correct Answer (A): Sclerophyllous leaves are tough, leathery leaves with a thick cuticle and adapted to resist water loss, making them characteristic of vegetation types found in Mediterranean climates. Chaparral vegetation, found in regions like California in the United States, parts of Australia, and the Mediterranean Basin, is dominated by shrubs and small trees with sclerophyllous leaves.

4. Correct Answer (B): Methane-producing bacteria (archaea) are among the earliest life forms on Earth, resembling conditions of early Earth's anaerobic environments. These microorganisms played a pivotal role in biogeochemical processes, such as the production of methane gas, which influenced Earth's early atmosphere and the evolution of life.

5. Correct Answer (C): Reproductive isolation is a key process in speciation, where populations become reproductively incompatible due to genetic, behavioral, or ecological barriers. This isolation prevents gene flow between populations, allowing genetic divergence and the formation of new species over evolutionary time scales. It is essential for maintaining biodiversity and driving the adaptive radiation of species into diverse ecological niches.

6. Correct Answer (B): In landscape ecology, landscape processes involve the exchange or movement of organisms, materials, and energy across different landscape elements such as patches, matrices, and corridors. These processes influence ecosystem dynamics, species interactions, and ecological patterns at various spatial scales. Understanding landscape processes is essential for conservation planning, habitat connectivity assessments, and management strategies aimed at maintaining biodiversity, ecosystem resilience, and ecological functionality.

7. Correct Answer (C):

(a) Fragmentation → (iv) Landscape: Fragmentation refers to the division of habitat into smaller, isolated patches, affecting the overall landscape.

(b) Assembly → (i) Community: Assembly refers to the composition of species within a community or ecosystem.

(c) Integrity → (ii) Ecosystem: Integrity relates to the overall health and function of an ecosystem, including its biodiversity and ecological processes.

(d) Dispersion → (iii) Population: Dispersion refers to the distribution pattern of individuals within a population across a given area.

8. Correct Answer (D): The Importance Value Index (IVI) is the sum of Relative Density, Relative Frequency, and Relative Dominance (Option D). IVI quantifies the ecological significance of a species within a community by integrating its abundance, frequency of occurrence, and dominance relative to other species. It helps ecologists assess the role and impact of species in an ecosystem.

$$\text{Relative Frequency} = \frac{Frequency\ of\ a\ species}{Frequency\ of\ all\ species} \times 100$$

$$\text{Relative Density} = \frac{Density\ of\ a\ species}{Density\ of\ all\ species} \times 100$$

$$\text{Relative Dominance} = \frac{Basal\ area\ of\ a\ species}{Basal\ area\ of\ all\ species} \times 100.$$

9. Correct Answer (A): Sikkim was the first state in India to be declared an organic state. In 2016, Sikkim achieved this status by converting its entire agricultural land to certified organic farming practices. The state's organic mission aimed to eliminate the use of chemical pesticides and fertilizers, promoting sustainable agriculture and environmental conservation. This achievement has positioned Sikkim as a model for organic farming and sustainable agricultural practices in India.

10. Correct Answer (B):

(a) Sympatric speciation (II): Differentiation within the same geographical area.

(b) Parapatric speciation (IV): Speciation between adjacent populations within a continuous habitat.

(c) Adaptive speciation (I): Formation of new species due to adaptation to changed environmental conditions.

(d) Allopatric speciation (III): Speciation due to geographical isolation.

11. Correct Answer (A):

- Smaller population (a) leads to the problem beginning.
- Inbreeding and genetic drift (b) occur in smaller populations, causing a reduction in genetic variability.
- Loss of genetic variability (c) results from inbreeding and drift.
- Lower individual fitness and population adaptability (d) arise from reduced genetic variability.
- Lower reproduction and higher mortality (e) follow, leading to further declines in population size.

12. **Correct Answer (B):** Ernst Haeckel, Coined the term "ecology" in 1866, making him the earliest contributor in this list. Geoffroy Saint-Hilaire, Made early contributions to comparative anatomy and the study of ecological relationships in the 19th century. Hanns Reiter, Contributed to ecological and environmental studies in the early 20th century. Arthur Tansley, Introduced the concept of the "ecosystem" in the 1930s, significantly advancing ecological science. Eugene Odum, Known as a pioneer of modern ecology, with major contributions in the 1950s and beyond.

13. **Correct Answer (C):** Social institutions encompass the norms, rules, and practices that govern the interactions and behaviors of a group, including those involved in hunting, fishing, and agriculture. They frame memory, creativity, and learning within the context of these activities.

14. **Correct Answer (C):** Local knowledge of land and animals is often considered the most stable scale because it encompasses detailed, long-standing understandings of specific ecosystems and their components.

15. **Correct Answer (C):** Traditional Ecological Knowledge primarily focuses on spatial scales, dealing with specific geographical and ecological contexts rather than encompassing temporal scales.

16. **Correct Answer (B):** Fact, Data, Information, Knowledge, Wisdom. This order represents the progression from raw data to more complex and integrated forms of understanding within the TEK framework.

17. **Correct Answer (C):** Local knowledge of land and animals, land and resource management system, social institutions, worldview represents the progression from specific ecological knowledge to broader social structures and overarching belief systems in Traditional Ecological Knowledge.

18. **Correct Answer (D):**
The process of **regional metamorphism** involves the transformation of rocks under high pressure and temperature, leading to a sequence of stages. The correct metamorphic sequence for shale is:

(A) **Slate**: Shale undergoes low-grade metamorphism to form slate, a fine-grained metamorphic rock.

(C) **Phyllite**: With further metamorphism, slate transforms into phyllite, characterized by a slightly higher grade of metamorphism and a shiny appearance due to increased mica.

(B) **Schist**: As the metamorphism continues, phyllite becomes schist, a more coarsely foliated rock with visible minerals like mica and garnet.

(D) **Gneiss**: With even higher-grade metamorphism, schist transforms into gneiss, which is banded and often contains quartz and feldspar.

19. **Correct Answer (A):** The **iron catastrophe** refers to the early differentiation of Earth, where dense elements like iron sank to form the core, while lighter materials rose to form the crust. This process resulted in the core containing much more iron than the crust, reflecting the impact of the iron catastrophe. Iron is abundant in Earth's core, which is why option **(1)** is correct.

20. **Correct Answer (C):** A new species typically originates through the process of **speciation**, which occurs when **natural selection** leads to adaptations that help organisms survive in different environments, and **reproductive isolation** prevents these organisms from interbreeding with other populations.
- **Natural selection** drives the survival and adaptation of organisms to their environment.
- **Reproductive isolation** occurs when genetic differences accumulate to the point where individuals from different populations cannot successfully reproduce.

21. **Correct Answer (C):** The early phototrophs likely used **Fe^{2+} (iron ions)** as an electron donor in the process of photosynthesis, particularly before they could use water (H_2O). Iron was abundant in the Earth's early oceans, and using Fe^{2+} as an electron donor allowed phototrophs to escape hydrothermal systems and colonize shallow waters, where light was available but protection from UV radiation was still needed.

22. **Correct Answer (B):** According to the passage, the cyanobacterial lineage evolved the ability to use **H_2O (water)** for photosynthesis, replacing **H_2S** (hydrogen sulfide), and began producing **O_2** as a waste product around **2.5-3.3 billion years ago**. Thus, the most probable time for the ability to use water for photosynthesis is around **3 billion years ago**.

23. **Correct Answer (A):** The first photosynthetic organisms were anoxygenic, meaning they did not produce oxygen (O_2) as a waste product. Instead, they used **H_2S (hydrogen sulfide)** as an electron donor, generating **elemental sulfur (S^o)** as a waste product. This aligns with the passage, where it states that the first phototrophs likely produced **S^o** as a byproduct of their photosynthesis.

24. Correct Answer (C): According to the passage, the first phototrophs likely carried out photosynthesis using **infrared radiation** generated by the heat of hydrothermal vents. These organisms were located in the complete darkness of the deep ocean, where **infrared radiation** was abundant due to the heat from hydrothermal systems. This allowed them to use infrared radiation for photosynthesis, as opposed to visible or ultraviolet light.

25. Correct Answer (B): The passage indicates that early phototrophs, once they adapted to using Fe^{2+} as an electron donor, were able to **escape from hydrothermal systems** and **colonize shallow regions of Earth's early oceans**. These regions provided **light** for photosynthesis but were still protected from harmful **UV radiation** by the overlying water. This suggests that the early photosynthetic organisms likely existed in these shallow areas of the oceans, where they could benefit from sunlight while being shielded from UV radiation.

Unit 3.2 : Ecosystem Structure and Functions: Structures - Biotic and Abiotic Components. Functions - Energy Flow in Ecosystems, Energy Flow Models, Food Chains and Food Webs. Biogeochemical Cycles, Ecological Succession. Species Diversity, Concept of Ecotone, Edge Effects, Ecological Habitats and Niche. Ecosystem Stability and Factors Affecting Stability. Ecosystem Services.

Previous Year Exam Questions

(DEC-2015)

1. The ability of a living system to be restored through secondary succession after a more severe disturbance is known as:
(A) Rehabilitation (B) Resistance
(C) Resilience (D) Restoration

(DEC-2015)

2. Which of the following is not a detrivore?
(A) Vultures (B) Earthworms
(C) Insects (D) Hydrilla

(DEC-2015)

3. Secondary succession begins at:
(A) base rock
(B) newly cooled lava
(C) burnt forest
(D) newly created shallow pond

(DEC-2015)

4. The total area of productive ecosystem required to support the population sustainably is known as:
(A) Ecological footprint
(B) Ecological handprint
(C) Carrying capacity
(D) Ecological services

(DEC-2015)

5. A measure that combines the number of species and their relative abundances compared with one another is termed:
(A) Species richness
(B) Species evenness
(C) Species diversity
(D) Species relationships

(DEC-2015)

6. The figures of humanity's global footprint (million hectares) for different countries estimated by WWF and Global Footprint Network in 2008 fall in the sequence:
(A) US > China > European Union > Japan > India
(B) China > US > Japan > India > European Union
(C) European Union > US > China > Japan > India
(D) US > European Union > China > India > Japan

(JULY-2016)

7. Energy transfer and nutrient flow through various trophic levels can be described as
(A) Linear
(B) Cyclic
(C) Linear and cyclic respectively
(D) Cyclic and linear respectively

(JULY-2016)

8. The highest rate at which individuals can be harvested without reducing the population size is called maximum sustainable yield of a
(A) Population (B) Community
(C) Ecosystem (D) Landscape

(JULY-2016)

9. Ecological restoration is the process of rebuilding a degraded ecosystem till
(A) it becomes pollution free and provides solace to the people.
(B) it becomes free of disturbance.
(C) its structure and functions are restored.
(D) it starts providing some ecosystem services.

(JULY-2016)

10. The overall diversity of a landscape comprising several ecosystems is known as
(A) Alpha diversity (B) Beta diversity
(C) Gamma diversity (D) Delta diversity

(JULY-2016)

11. Ecosystem degradation refers to
(a) loss or decrease in biodiversity.
(b) modification in structure of abiotic components.
(c) impairment of ecosystem processes such as nutrient cycling.
Choose the correct answer:
(A) (a) only (B) (a) and (b) only
(C) (b) and (c) only (D) (a), (b) and (c)

(JULY-2016)

12. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):

Assertion (A): As per equilibrium theory of island biogeography, distance of the islands from the mainland determines the dispersal rate of new species.

Reason (R): Size of an island is important in determining number of species.

Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).

(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).

(C) (A) is true, but (R) is false.

(D) (A) is false, but (R) is true.

(JULY-2016)

13. Landscape mosaic comprises

(A) matrices and patches

(B) patches and corridors

(C) matrices, patches and corridors

(D) matrices and comidors

(JULY-2016)

14. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):

Assertion (A): The ecosystem surrounding a river gets damaged due to the construction of a dam on it.

Reason (R): The area in upper catchment of the river gets inundated.

Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).

(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).

(C) (A) is true but (R) is false

(D) (A) is false but (R) is true.

(JULY-2016)

15. Evolution can be viewed as

(a) genetic change over time

(b) a process of descent with modification

(c) a sudden change in organism

(d) a man-made change in organisms

Choose the correct code:

(A) (a) and (b) only (B) (b) and (c) only

(C) (c) and (d) only (D) (a) and (d) only

(JAN-2017)

16. A niche of the species where there is no competition from other species is called

(A) hyper volume niche (B) habita

(C) fundamental niche (D) realized niche

(JAN-2017)

17. Taxonomic diversity of a region with several ecosystems is:

(A) Alpha diversity (B) Beta diversity

(C) Gamma diversity (D) Sigma diversity

(JAN-2017)

18. As the number of species in a food web increases

(A) Food chain length tends to increase

(B) System tends to be unstable

(C) Energy flow decreases

(D) System tends to collapse completely

(JAN-2017)

19. The purpose of offshore islands is focussed for site or landscape restoration to

(A) provide linkage between movement and genetic interchange of species.

(B) foster populations of endangered species without native or introduced predators.

(C) increase the availability of habitats.

(D) increase the stabilization of surface cover and protect the animal corridor on land.

(NOV-2017)

20. In an ecosystem, which one of the following is a micro-consumer?

(A) Herbivores (B) Omnivores

(C) Carnivores (D) Saprotrophs

(NOV-2017)

21. A structure with hundreds of species nonlinearly interlinked for their livelihood is called:

(A) Guild (B) Food chain

(C) Food web (D) Pyramid

(NOV-2017)

22. The process of examination of change in species diversity between ecosystems is a measure of:

(A) Alpha diversity (B) Beta diversity

(C) Gamma diversity (D) Genetic diversity

(NOV-2017)

23. The unidirectional series of changes from an uninhabited water body to a water body inhabited by a stable aquatic community are called:

(A) Eutrophication (B) Succession

(C) Regeneration (D) Reclamation

(NOV-2017)

24. Under the clear Sunny day, the maximum depth of the ocean at which photosynthesis can occur is:

(A) $10\ m$ (B) $250\ m$

(C) $80\ m$ (D) $600\ m$

(NOV-2017)

25. In the total global ecological footprint, which country has the maximum share:

(A) USA (B) China

(C) India (D) Brazil

(NOV-2017)

26. Which factor(s) may affect species richness on an island?

(a) Area of the island

(b) Distance from the mainland

(c) Shape of the island

Choose the correct code:

(A) (a) and (b) only (B) (b) and (c) only

(C) (a) and (c) only (D) (a),(b) and (c)

(JUNE-2021)

19. The minimum time needed for the formation of one inch of the top soil is:

(A) Less than 10 years (B) $10 - 50$ yours
(C) $100 - 400$ years (D) $1{,}000 - 2{,}000$ year

(JUNE-2021)

20. The process of illuviation in soil indicates:

(A) Removal of particles from the top soil
(B) Removal of particles from the C horizon
(C) Percolation of soluble salts into deeper soil layers
(D) Accumulation of particles is the B horizon

(JUNE-2021)

21. Consider the following statements regarding clay minerals in soil:

(a) Some clay particles are technically not colloids yet they have colloid like properties
(b) There are four major types of colloids present in soil
(c) All types of clays are crystalline in nature
(d) Soil humus are not considered as colloids

Choose the most appropriate answer from the options given below:

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

(JUNE-2021)

22. Match List-I with List-II.

List-I (Mineral type)	List-II (Geometric shape)
(a) Helicitic	(i) Arranged like a star
(b) Micaceous	(ii) Consists of small ellipsoid or spheroids
(c) Oolitic	(iii) Consists of thin plate like lamelae
(d) Stellate	(iv) Twisted and curved, like coral branching

Choose the most appropriate answer from the options given below:

(A) a-iv, b-iii, c-i, d-ii (B) a-iv, b-iii, c-ii, d-i
(C) a-i, b-ii, c-iii, d-iv (D) a-i, b-ii, c-iv, d-iii

(SEP-2022)

23. Arrange the following minerals with increasing order of stability for weathering.

(a) Ilite
(b) Olivine
(c) Calcite
(d) Ca rich feldspar
(e) Na rich feldspar

Choose the correct answer from the options given below:

(A) (b),(c),(d),(e),(a) (B) (b),(c),(c),(d),(a)
(C) (c),(b),(c),(d),(a) (D) (c),(b),(d),(e),(a)

(SEP-2022)

24. Identify the correct sequence of the given soil texture classes in decressing order of stability of wet clods:

(a) Loam
(b) Clay
(c) Sandy Loam
(d) Silt Loam
(e) Clay Loam

Choose the correct answer from the options given below:

(A) (a),(b),(d),(e),(c) (B) (b),(e),(d),(a),(c)
(C) (b),(d),(a),(c),(e) (D) (b),(e),(a),(c),(d)

(SEP-2022)

25. The grain size (USDA) of silt in soil ranges between:

(A) $0.2\ mm$ to $0.5\ mm$
(B) $0.5\ mm$ to $0.1\ mm$
(C) $0.1\ mm$ to $0.05\ mm$
(D) $0.05\ mm$ to $0.002\ mm$

(SEP-2022)

26. Match List-I with List-II.

List-I (Theory)	List-II (Proponent)
(a) Andisol	I. Permafrost, often with cryoturbation
(b) Gelisols	II. High in swelling clays, deep cracks when soil is dry
(c) Histosols	III. From volcanic ejecta, dominated by allophone or Al-humic complexes
(d) Vertisols	IV. Peat or bog: >20% organic matter

Choose the correct answer from the options given below:

(A) a-II, b-III, c-IV, d- I (B) a-III, b-I, c-IV, d-II
(C) a-IV, b-III, c-II, d-I (D) a-I, b-II, c-III, d-IV

(MAR-2023)

27. Orthoclace weathers to produce:

(a) silica
(b) dissolved K ion
(c) smectite
(d) kaolinite
(e) dissolved biocarbonate ion

Choose the correct answer from the options given below:

(A) (a),(b) and (c) only
(B) (a),(c) and (d) only
(C) (a),(b),(c) and (d) only
(D) (a), (b), (d) and (e) only

(MAR-2023)

28. Correct order of soil horizons starting from top surface to bottom is:

(a) 0
(b) A
(c) B
(d) R
(e) C

Choose the correct answer from the options given below:

(A) (a),(b),(c),(e),(d) (B) (a),(b),(c),(d),(e)
(C) (a),(b),(d),(c),(e) (D) (b),(a),(c),(d),(e)

(MAR-2023)

29. Given below are two statements:

Statement I: Past data records help in forecasting weather conditions.

Statement II: The statistical methods of correlation help ONLY in forecasting weather conditions.

In light of the above statements, choose the most appropriate answer from the options given below:

(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true, but Statement II is false
(D) Statement I is false, but Statement II is true

(JUNE 2024)

30. Arrange the following soil horizons from top to bottom:

(a) O_a – Horizon
(b) E - Horizon
(c) A - Horizon
(d) B - Horizon
(e) O_i – Horizon

Choose the correct answer from the options given below:

(A) a, e, c, b, d (B) e, a, c, b, d
(C) e, a, c, d, b (D) a, e, c, d, b

(JUNE 2024)

31. Arrange the following in increasing order of weathering vulnerability:

(a) Halite
(b) Carbonate
(c) Quartz
(d) Feldspar
(e) Olivine

Choose the correct answer from the options given below:

(A) a, b, c, d, e (B) e, b, a, d, c
(C) c, d, e, b, a (D) d, a, c, b

(SEP-2024)

32. Arrange the following soil types in increasing order of percentage organic matter content.

a. Forest soils (Surface horizons)
b. Temperate Agriculture Soils
c. Peat Soils
d. Tropical agricultural soils

Choose the most appropriate answer from the options given below:

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

(JAN-2025)

33. Arrange the following aquifer materials in increasing order of their porosity.

(a) Clay (b) Limestone
(c) Gravel (d) Fine Sand

Choose the correct answer from the options given below:

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

(JAN-2025)

34. Identify the correct sequence of coal grade formation from sedimentary to metamorphic rock.

(a) Peat
(b) Anthracite
(c) Bituminous
(d) Lignite

Choose the correct answer from the options given below:

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

(JAN-2025)

35. Match List-I with List-II.

List-I (Mineral)	List-II (Silicate structure)
A. Augite	(I) Double Chains
B. Hornblende	(II) Single Chains
C. Biotite	(III) Three dimensional network
D. Quartz	(IV) Sheet

Choose the correct answer from the options given below:

(A) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)
(B) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(C) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(D) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

(JAN-2025)

36. Match List-I with List-II.

List-I (Substance)	List-II (Chemical compounds)
(A) Lime stone	(I) Calcium carbonate
(B) Slaked lime	(II) Aqueous solution of calcium hydroxide
(C) Quick lime	(III) Calcium oxide
(D) Lime water	(IV) Calcium hydroxide

Choose the correct answer from the options given below:

(A) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(B) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)
(C) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(D) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

(JAN-2025)

37. The process, which is NOT part of the Sedimentary rock formation, is:

(A) Deposition (B) Intrusion
(C) Lithification (D) Erosion

(JUNE 2025)

38. Match the LIST-I with LIST-II

LIST-I (Soil Type)	LIST-II (Major Characteristics)
A. Vertisols	I. Little profile development, ochric epipedon common

B. Histosols	II. Usually formed on volcanic ash dominated by allophane
C. Entisols	III. High in swelling clays, deep cracks in dried soils
D. Andisols	IV. Undergone little profile development, >20% organic matter

Choose the correct answer from the options given below:

(A) A-II, B-IV, C-III, D-I (B) A-I, B-II, C-IV, D-III
(C) A-III, B-IV, C-I, D-II (D) A-IV, B-III, C-II, D-I

Comprehension: (39 to 43)

Read the following passage and answer the question:

Hydrothermal fluids at spreading centers of Mid Oceanic Ridges originate due to circulation of sea water through hot volcanic rocks. Heated rocks and deeper magmas pull in the cold seawater, heat it and then pull out the hydrothermal fluid- the hot water. The hydrothermal water laden with metals and many other elements returns back into the overlying oceans. Circulating sea water through porous volcanic rocks not only cools the lithosphere but also contribute to the sea water chemistry, and formation of important mineral deposits of Co, Ni, Lanthanides and PGES. Continental weathering also contributes to the seawater composition. The hydrothermal energy and nutrients support complex ecosystems at Mid Oceanic Ridges. Microorganisms in the ecosystem also play important role in the precipitation of minerals. In the year 2024, India having with two ocean probes, applied to International Sea Bed Authority under the UN Convention on the Law of the Sea (UNCLOS) to explore deep sea around Carlsberg Ridge in the north western limb of the Indian Ocean Ridge system, and Afanasy Nikitin Seamount in the Central Indian basin. These missions can yield minerals and metals, associated with crusts and nodules, important in clean energy transition and other strategic importance.

(JUNE 2025)

39. Which of the following is mainly contributed to the sea water composition by volcanic activities?

(A) Na^+ (B) HCO_3^-
(C) CI^- (D) K^+

(JUNE 2025)

40. Which of the following represents steepest geothermal gradient?

(A) Continent-continent Collison mountains
(B) Subduction zone
(C) Mid Oceanic Ridges
(D) Old and thick lithosphere

(JUNE 2025)

41. Cobalt, Nickel and lanthanides belong to _____.

(A) Rare earth elements
(B) Critical metals
(C) Hydrothermal elements
(D) Chalcophile elements

(JUNE 2025)

42. Formation of polymetallic nodules on the surface of ocean indicates _____.

(A) anoxic environment
(B) oxic environment
(C) very low pH conditions
(D) high salinity conditions

(JUNE 2025)

43. Carlsberg Ridge represents boundary between _____.

(A) Indian and Arabic plates
(B) Indian and Eurasian Plates
(C) Indian and Somalian Plates
(D) Indian and Australian Plates

(JAN 2026)

44. Arrange the following metamorphic rocks in order of increasing grade of metamorphism.

A. Schist
B. Phyllite
C. Slate
D. Gneiss

Choose the correct answer from the options given below:

(A) A, B, C, D (B) B, C, D, A
(C) C, B, A, D (D) D, C, B, A

(JUNE 2026)

45. Arrange the following minerals in the increasing order of their rate of weathering (from least to most weatherable).

A. Pyroxene B. Albite
C. Hematite D. Calcite
E. Quartz

Choose the correct answer from the options given below:

(A) E, B, A, C, D (B) D, A, B, E, C
(C) E, B, C, A, D (D) C, E, B, A, D

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

EXPLANATION

1. **Correct Answer (A):** A **Lysimeter** is a specialized instrument used in soil science and hydrology to measure the movement of water through soil layers. It consists of a container buried in the ground with a known volume of soil, allowing researchers to monitor water movement under natural conditions.

2. **Correct Answer (D):** Deltas are landforms formed at the mouths of rivers where sediment carried by the river is deposited as the river flow slows upon entering a larger body of water. The classification of deltas takes into account the processes of (a) rivers, which deliver sediment, (b) waves, which redistribute sediment along coastlines, and (c) tides, which affect the distribution of sediments near the delta front. These factors influence the shape and structure of deltas, resulting in classifications that consider the dominant influence of each process.

3. **Correct Answer (C):** Poor aeration and high water-holding capacity are characteristic features of clay soil. Clay particles are very small and tightly packed, which limits air flow and retains water for long periods, making it difficult for water to drain quickly.

4. **Correct Answer (C):** The assertion (A) states that soil development begins with physical, chemical, and biological weathering of rocks. This is true because the weathering of rocks into smaller particles is a fundamental process in the formation of soil. The reason (R) states that anthropogenic factors play a major role in soil formation. While human activities such as agriculture, deforestation, and urbanization can influence soil properties and accelerate soil formation processes, they are not the primary factors initiating soil development. The primary factors are natural processes like weathering.

5. **Correct Answer (C):**

- **Exfoliation dome** - This is a geological feature formed through **mechanical weathering** (especially unloading and expansion processes).
- **Rift valleys** - These are large elongated depressions with steep walls formed by the downward displacement of a block of the Earth's surface between nearly parallel faults or fault systems, indicating **landform change**.
- **Palaeomagnetism** - This is the study of the record of the Earth's magnetic field in rocks, sediment, or archeological materials. It provides evidence for **seafloor spreading**.
- **Pedogenesis** - This is the process of soil formation, leading to the creation of **ultisols** (a type of soil).

6. **Correct Answer (A):** Amphibole and biotite mica are common examples of ferromagnesian minerals found in igneous and metamorphic rocks. These minerals are rich in iron (Fe) and magnesium (Mg) and contribute to the dark color and dense texture of these rocks. Amphiboles form elongated crystals and include varieties like hornblende, while biotite mica has a layered structure that lends itself to sheet-like flakes. Understanding these minerals helps in identifying rock types and interpreting their geological history.

7. **Correct Answer (B):** Albedo refers to the reflectivity of a surface. Dry sand has a relatively high albedo compared to other natural surfaces, meaning it reflects a significant portion of incoming solar radiation. Leafy crops and calm sea water have lower albedo, and dark asphalt has the lowest, absorbing most of the solar radiation.

8. **Correct Answer (A):** The zone with the highest erosion rate in the journey of a river is the **Headwater**. This is where the river begins, often in steep, mountainous areas, where the gradient is high, leading to significant erosion as the river cuts through the landscape.

9. **Correct Answer (A):** Sandy soil, characterized by particle sizes of 0.05-2.0 mm, promotes good drainage and aeration due to its large pore spaces. These spaces allow water to move freely through the soil, preventing waterlogging and facilitating oxygen flow to plant roots. Sandy soils are well-suited for plants that require excellent drainage and do not tolerate waterlogged conditions. The particles' size and arrangement also contribute to their ability to warm up quickly in the spring, making them favorable for early planting. Overall, sandy soils are valued in agriculture and gardening for their efficient water management and aeration properties, crucial for healthy plant growth.

10. **Correct Answer (D):** Saline and alkaline soils typically exhibit poor drainage due to high salt content, leading to waterlogging and impeded root growth. These soils often show white incrustations (option A) from salts and are generally infertile (option B) due to imbalanced nutrient availability. Option D, stating these soils are pervious, is incorrect because their high salt content makes them relatively impermeable to water.

11. **Correct Answer (D):** The correct matching of Clay Minerals (List-I) with their respective Cation Exchange Capacities in cmol(+) kg^{-1} (List-II) is as follows:

(a) Vermiculite → (iv) 150-160
(b) Smectite → (iii) 100-120
(c) Illite → (ii) 20-40
(d) Kaolinite → (i) 5-25

12. **Correct Answer (D):** Soil types vary in compressibility based on their particle size and mineral composition. Sandy clay, characterized by small particle sizes and high mineral content, exhibits very high compressibility. This property affects soil stability, engineering projects, and land use planning, influencing construction practices and environmental management strategies.

13. **Correct Answer (C):** Humin is an organic substance found in soil that is insoluble in both acid and alkali. It forms from partially decomposed organic matter and contributes to soil structure and nutrient retention. Fulvic acid and humic acid, however, can dissolve in both acid and alkali under varying conditions, playing roles in nutrient cycling and soil fertility.

14. **Correct Answer (B):** Fulvic acid molecules in soil humus are more polar, highly charged, and smaller molecules than humic acid molecules. Fulvic acids have a lower molecular weight and higher oxygen content, making them more soluble in water and more chemically reactive. They play a crucial role in nutrient transport and availability in soils. These properties distinguish them from humic acids, which are larger and less soluble. Therefore, option (B) is correct.

15. **Correct Answer (B):** Humic acids are a group of molecules that bind to, and help plant roots receive, water and nutrients. They are formed through the decay of plant and animal matter. Humic acids are insoluble in acidic conditions (pH < 2) but are soluble in alkaline conditions. This insolubility in acid is due to the high molecular weight and complex aromatic structures of humic acids, which precipitate out in low pH environments.

16. **Correct Answer (A):** Montmorillonite is a type of smectite clay mineral known for its high interlayer expansion due to its ability to adsorb large amounts of water and cations between its layers. This property makes it highly expandable and capable of increasing its volume significantly when wet. Montmorillonite's structure consists of two silica tetrahedral sheets sandwiching an alumina octahedral sheet, with weak bonds between the layers that allow for the absorption of water and cations.

17. **Correct Answer (C):** In moderately acidic soils, base saturation is higher than in strongly acidic soils, and aluminium hydroxy ions act as exchangeable cations. Free aluminium ions are less abundant compared to strongly acidic soils. Small amounts of readily exchangeable hydrogen contribute to soil acidity. These conditions affect nutrient availability, microbial activity, and plant growth, making soil pH management essential for maintaining soil health and productivity.

18. **Correct Answer (A):** Isomorphous substitution is the process where one cation substitutes for another of similar size in the crystal lattice of silicate clays, leading to a permanent charge imbalance. This substitution occurs in the tetrahedral or octahedral sheets of the clay structure. The resulting constant charges are a fundamental property of soil silicate clays, influencing their cation exchange capacity (CEC) and interactions with soil nutrients and pollutants. These charges are crucial for soil fertility and the retention and availability of essential nutrients for plant growth.

19. **Correct Answer (C):** Topsoil formation is a slow process influenced by various factors such as parent material, climate, and biological activity. It generally takes between 100 to 400 years for natural processes to form one inch of topsoil. This slow rate underscores the importance of soil conservation, as soil erosion can occur much faster than soil formation.

20. **Correct Answer (D):** Illuviation is the process where dissolved or suspended soil materials are transported from upper layers (like the A horizon) and accumulate in the lower layers (B horizon). This process results in the enrichment of the B horizon with clay, iron, or organic compounds, forming distinct soil horizons

21. **Correct Answer (C):** Clay minerals, though not always technically colloids, exhibit colloid-like properties due to their small size and high surface area. Soils contain four major types of colloids: clay minerals, organic humus, iron and aluminum oxides, and amorphous materials. Not all clays are crystalline; some may have amorphous structures. Soil colloids, including clays and humus, significantly influence soil properties such as nutrient retention, water holding capacity, and cation exchange capacity. Understanding the nature and behavior of soil colloids is essential for soil management, agriculture, and environmental conservation.

CHAPTER-6 ENVIRONMENTAL POLLUTION AND CONTROL

Unit 6.1: Air Pollution: Sources and types of Pollutants - Natural and anthropogenic sources, primary and secondary pollutants. Criteria air pollutants. Sampling and monitoring of air pollutants (gaseous and particulates); period, frequency and duration of sampling. Principles and instruments for measurements of (i) ambient air pollutants concentration and (ii) stack emissions. Indian National Ambient Air Quality Standards. Impact of air pollutants on human health, plants and materials. Acid rain. Dispersion of air pollutants. Mixing height/depth, lapse rates, Gaussian plume model, line source model and area source model. Control devices for particulate matter: Principle and working of: settling chamber, centrifugal collectors, wet collectors, fabric filters and electrostatic precipitator. Control of gaseous pollutants through adsorption, absorption, condensation and combustion including catalytic combustion. Indoor air pollution, Vehicular emissions and Urban air quality.

Previous Year Exam Questions

(DEC-2015)

1. Which of the following is a secondary aerosol?
(A) Pollens
(B) Virus
(C) Sodium Chloride
(D) Ammonium Sulphate

(DEC-2015)

2. In the colorimetric determination of ambient SO_2 by WEST-GAEKE method, the absorbance of the coloured complex should be measured at which of the following wavelengths?
(A) $550\ nm$ (B) $650\ nm$
(C) $450\ nm$ (D) $350\ nm$

(DEC-2015)

3 Which one of the following statements is not true in the case of point source Gaussian Plume Model?
(A) Wind speeds are constant in time
(B) Pollutants are conservative
(C) Rate of emission of pollutants from the stack is constant
(D) The ground level concentration is inversely proportional to effective stack height

(DEC-2015)

4. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R).
Assertion (A): All types of aerosols contribute to radiative forcing.
Reason (R): Aerosol effectively absorb electromagnetic radiations.
Choose the correct answer:
(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

(DEC-2015)

5. According to National Ambient Air Quality Standards in India, the permissible 24 hour average concentration of lead in ambient air of an industrial area is:
(A) $1.0\mu g/m^3$ (B) $2.0\mu g/m^3$
(C) $3.03\mu g/m^3$ (D) $4.0\mu g/m^3$

(DEC-2015)

6. Dioxins and Furans are two toxic gaseous pollutants which can be measured by:
(A) GC – MS (B) TLC
(C) ICP – AES (D) AAS

(DEC-2015)

7. According to CPCB standards, the annual average concentration of $PM_{2.5}$ should not exceed:
(A) $60\mu gm^{-3}$ (B) $40\mu gm^{-3}$
(C) $80\mu gm^{-3}$ (D) $100\mu gm^{-3}$

(DEC-2015)

8. Which of the following actions may be recommended for acidified lakes?
(A) Ammoniation (B) Liming
(C) Ozonation (D) Chlorination

(DEC-2015)

9. The shape of a plume from a tall stack located on a flat terrain is found to be of "fanning" type. It implies that the atmosphere is under the condition of:
(A) Strong lapse rate
(B) Weak lapse rate
(C) Inversion
(D) Weak lapse rate below inversion

(JULY-2016)

10. Consider the following statements in case of Gaussian Plume Model.
(a) The wind speed is constant both in time and with elevation.
(b) The emission rate from the source is constant.
(c) The pollutant is conservative
Choose the answer:

appropriate filtering velocity is $2.0\ m/minute$ for a continuous cleaning operation. How many bags are there?

(A) 34 (B) 38
(C) 40 (D) 42

(JUNE 2026)

61. Which of the following is true about photochemical smog formation in the ambient atmosphere?

(A) Ozone, formaldehyde, and acrolein are components of photochemical smog.
(B) Higher $\frac{NO}{NO_2}$ ratios will favor tropospheric ozone formation.
(C) NO_2, VOCs, SO_2, and $H_2O_{(v)}$ are essential ingredients of photochemical smog.
(D) Photochemical smog protects humans and ecosystems from harmful UV-B radiations.

(JUNE 2026)

62. Choose the INCORRECT statement about formation and impact of acid rain.

(A) Nitric oxide is not especially soluble in water and thus NO, itself, do not make rainwater particularly acidic.
(B) Neutralization of acid rain by limestone produces carbon dioxide.
(C) Areas having granite or quartz bedrock, compared to carbonates, are more affected by acid rain.
(D) At high altitudes, fog and mists are less acidic than precipitation, probably due to more water availability for dilution.

(JUNE 2026)

63. Match List I with List II

List I (Emissions from Smoke Stack)		List II (Shape of Plume)	
A	Pollutants emitted in neutrally stable atmosphere	I	Fanning
B	Pollutants emitted in stable atmosphere, vertical dispersion restricted	II	Looping
C	Pollutants emitted from smoke stack below thermal inversion height	III	Coning
D	Pollutants emitted in unstable atmosphere	IV	Fumigation

Choose the correct answer from the options given below:

(A) A-I, B-III, C-II, D-IV (B) A-III, B-I, C-IV, D-II
(C) A-III, B-IV, C-I, D-II (D) A-II, B-III, C-IV, D-I

(JUNE 2026)

64. Choose the correct statement about O_3 chemistry in stratosphere.

A. Third molecule such as N_2 or H_2O carry away the heat generated during ozone formation.
B. Conversion of inactive to active chlorine occurs at the surface of particles formed by a solution of water.
C. Process of denitrification in lower stratosphere enhances/helps in ozone destruction.
D. OH/H_2O is a catalytic cycle for ozone destruction.
E. $[O_3]_{ss}/[O_2]_{ss}$ ratio is directly proportional to air density through third body molecules [M], not involved in ozone formation/destruction process.

Choose the most appropriate answer from the options given below:

(A) A, B, C and D only (B) A, B, C and E only
(C) A, B and C only (D) A, C and D only

(JUNE 2026)

65. Cyclones are used for particle collection from the ambient atmosphere. The ratio of the induced force (F_c) in the cyclone to the gravitational force (F_g) will change by_____ folds if rotational speed of cyclone is increased from 2 m/sec to 4 m/sec.

(A) two (B) four
(C) Eight (D) sixteen

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
D	A	D	C	A	A	B	B	C	D
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A	A	C	D	B	C	B	B	B	D
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
A	A	C	D	A	D	C	B	D	B
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
C	B	B	A	D	B	D	B	C	B
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
C	B	A	B	B	C	B	D	B	A
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
D	C	A	B	C	C	B	A	D	C
61	**62**	**63**	**64**	**65**					
A	D	B	C	B					

EXPLANATION

1. Correct Answer (D): Ammonium sulfate $(NH_4)_2SO_4$ is a secondary aerosol, formed from the chemical reactions of primary pollutants such as sulfur dioxide (SO_2) and ammonia (NH_3) in the atmosphere. Secondary aerosols are not directly emitted into the air but result from complex photochemical reactions involving gases. These aerosols contribute to atmospheric haze, influence climate by affecting the Earth's radiative balance, and have health implications by exacerbating respiratory conditions.

Formation of Ammonium Salts:

$NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$
$NH_3 + HNO_3 \rightarrow NH_4NO_3$

2. **Correct Answer (A):** In the colorimetric determination of ambient sulfur dioxide (SO_2) by the WEST-GAEKE method, the absorbance of the colored complex should be measured at 550 nm. This method involves the reaction of SO_2 with pararosaniline and formaldehyde to form a colored complex whose intensity, measured at this wavelength, is proportional to the SO_2 concentration in the air. Accurate wavelength selection is crucial for reliable quantification in spectrophotometric analysis.

3. **Correct Answer (D):** The statement that is not true in the case of the point source Gaussian Plume Model is "The ground level concentration is inversely proportional to effective stack height." In the Gaussian Plume Model, the ground level concentration of pollutants is actually inversely proportional to the square of the effective stack height, not just inversely proportional. The effective stack height affects the dispersion and dilution of pollutants; a higher stack height generally results in lower ground-level concentrations due to better dispersion of the plume.

4. **Correct Answer (C):** Radiative forcing measures the influence of a factor, such as aerosols, on the energy balance of the Earth's atmosphere. Aerosols affect radiative forcing through scattering and absorbing sunlight and infrared radiation. However, not all aerosols absorb electromagnetic radiation effectively. For instance, sulfate aerosols primarily scatter light, leading to a cooling effect by reflecting sunlight away from the Earth. In contrast, black carbon aerosols absorb sunlight, contributing to warming. Therefore, while all aerosols contribute to radiative forcing, they do so through different mechanisms, and not all are effective at absorbing electromagnetic radiation. This explains why the reason provided does not**Correct**ly explain the assertion.

5. **Correct Answer (A):** National Ambient Air Quality Standards (NAAQS) in India set limits for air pollutants to protect human health and the environment. The permissible 24-hour average concentration of lead in ambient air of industrial areas is 1.0 micrograms per cubic meter (µg/m^3). Lead is a toxic heavy metal harmful to human health, particularly affecting neurological development in children. Monitoring and regulating lead emissions are crucial for maintaining air quality and mitigating health risks in industrialized areas.

6. **Correct Answer (A):** Dioxins and Furans are typically measured by (A) GC-MS (Gas Chromatography-Mass Spectrometry). This technique is highly effective for analyzing these toxic pollutants due to its sensitivity and ability to separate and identify complex mixtures of compounds based on their mass and chemical properties. GC-MS is widely used for detecting and quantifying trace levels of dioxins and furans in various environmental samples.

7. **Correct Answer (B):** According to the Central Pollution Control Board (CPCB) standards in India, the annual average concentration of $PM_{2.5}$ should not exceed 40 µg/m³. $PM_{2.5}$ refers to particulate matter with a diameter of less than 2.5 micrometers, which can penetrate deep into the lungs and even enter the bloodstream, posing significant health risks. Stringent standards are essential to protect public health from the adverse effects of air pollution, including respiratory and cardiovascular diseases.

8. **Correct Answer (B):** For acidified lakes, **Liming** is a recommended action. Liming involves adding limestone (calcium carbonate) to the water to neutralize acidity and increase the pH level. This process helps in restoring the aquatic ecosystem by reducing the harmful effects of acidification on fish and other aquatic organisms. Liming also improves water quality, making it more suitable for recreational and other uses. Other options, such as ammoniation, ozonation, and chlorination, are not effective for treating acidified lakes and may have adverse environmental impacts.

9. **Correct Answer (C):** Inversion layers occur when a layer of warmer air sits above cooler air near the ground, which prevents vertical mixing and causes pollutants to spread horizontally. This can lead to a "fanning" plume shape, as the pollutants spread out more horizontally due to the limited vertical dispersion caused by the inversion.

10. **Correct Answer (D):** The Gaussian Plume Model assumes that wind speed is constant both in time and with elevation (a), the emission rate from the source is constant (b), and the pollutant is conservative (c). These assumptions help in predicting the dispersion of pollutants in the atmosphere under specific meteorological conditions.

11. **Correct Answer (A):** The behavior of plumes emitted from tall stacks depends on atmospheric conditions, particularly lapse rates. Given the lapse rates, the expected plume behavior is looping (A).

- Looping occurs when the environmental lapse rate (Γ_"env") exceeds the adiabatic lapse rate (⌈), causing the plume to oscillate vertically.
- This behavior is influenced by temperature gradients in the atmosphere, which affect the buoyancy and dispersion of pollutants emitted from industrial stacks.
- Looping plumes can result in localized dispersion patterns, affecting air quality and pollutant distribution in surrounding areas.

  Thus, understanding plume behavior helps assess the environmental impacts of industrial emissions and implement effective pollution control measures.

12. Correct Answer (A): Hydrogen combustion can produce pollution due to the formation of nitrogen oxides (NOx) when hydrogen reacts with atmospheric oxygen at high temperatures. Assertion (A) Correctly identifies this aspect, emphasizing that hydrogen combustion does produce some pollution.

- Reason (R) explains that the heat produced during hydrogen combustion can chemically combine atmospheric nitrogen (N2) and oxygen (O2), forming NO_x compounds.
- NOx compounds contribute to air pollution and can have adverse effects on human health and the environment, including smog formation and respiratory problems.

  Both statements (A) and (R) are Correct, and (R) provides a valid explanation for (A). Therefore, the Correct answer is (A) Both (A) and (R) are Correct and (R) is the Correct explanation of (A).

13. Correct Answer (C): Acid rain is formed when certain gases, primarily sulfur dioxide (SO2) and nitrogen oxides (NOx), react with water vapor and other atmospheric constituents to form sulfuric acid and nitric acid. These acids then fall to Earth as acid rain, impacting ecosystems and water quality. Nitrous oxide (N2O) is not typically considered a precursor to acid rain.

14. Correct Answer (D): According to the World Health Organization (WHO) report in 2015, India had 13 out of the 20 most polluted cities in the world based on levels of particulate matter (PM2.5) in the air. Particulate matter is a major component of air pollution that poses significant health risks to human populations, including respiratory and cardiovascular diseases.

15. Correct Answer (B): Pollen grains and fungal spores: These bioparticulates are major allergens that trigger immune responses in susceptible individuals, leading to allergic reactions such as hay fever and asthma. Pollen grains are reproductive structures produced by flowering plants during their reproductive cycle. Fungal spores, on the other hand, are reproductive structures of fungi released into the air to facilitate fungal reproduction and dispersion. Both pollen grains and fungal spores are lightweight and easily dispersed by wind, contributing significantly to airborne allergen levels, especially during pollen seasons and in environments with high fungal activity.

16. Correct Answer (C):

Assertion (A) is generally true. Tall stacks are installed at power stations and polluting industries to disperse pollutants higher into the atmosphere, reducing their concentration at ground level and potentially minimizing local impacts.

However, **Reason (R**) is false. The dispersion of pollutants from a stack is influenced by various factors including wind speed, atmospheric stability, and the nature of the pollutant itself, not solely by the height of the stack. While taller stacks can aid dispersion to some extent, the relationship is not strictly inversely proportional as suggested.

17. Correct Answer (B): The Gaussian Plume Dispersion model is used to predict the dispersion of pollutants in the atmosphere under certain assumptions:

- Statement (a) is false: Pollutants in the atmosphere do not necessarily have the same density as air; they can vary in density depending on their chemical composition.
- Statement (b) is true: The stability of the atmosphere influences the vertical mixing of pollutants. Stable atmospheric conditions can lead to the accumulation of pollutants near the ground, affecting dispersion patterns. Therefore, the**Correct** answer is (B): (a) is false, (b) is true.

18. Correct Answer (B): To find the maximum ground level concentration using the Gaussian plume model, we use the following formula:

$C(x,0,0)= \frac{Q}{2\pi u \sigma_y \sigma_z} \exp\left[\frac{-H^2}{2\sigma^2 Z}\right]$

Where:

- C(x,0,0) is the ground level concentration at the plume centerline
- Q is the emission rate (5.0 g/s)
- u is the wind speed (2.0 m/s)
- σ_y is the lateral dispersion parameter (50.0 m)
- σσ_z is the vertical dispersion parameter (30.0 m)
- H is the effective stack height (30.0 m)

Plugging in the values:

$C(x,0,0)=\frac{5.0}{2\pi \cdot 2.0 \cdot 50.0 \cdot 30.0} \exp\left[\frac{-30.0^2}{2X\ 30.0^2}\right]$

First, simplify the exponential term:

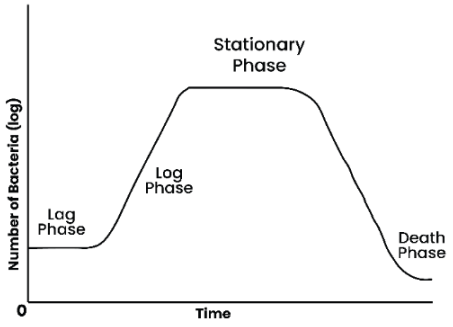
31	32	33	34	
B	B	A	B	

EXPLANATION

1. **Correct Answer (A):** Convenience sampling is a type of nonprobability sampling. This method involves selecting a sample based on ease of access and proximity to the researcher, rather than using a random or systematic approach. While convenient and cost-effective, it often leads to biased results because it does not represent the entire population accurately. The lack of randomness means that certain segments of the population may be overrepresented or underrepresented, limiting the generalizability of the findings.

2. **Correct Answer (D):** CI= $\underline{X} \pm z \times \frac{SD}{\sqrt{n}}$
Sample mean ($\underline{X}$) = 30 cm
Sample standard deviation (SD) = 6 cm
Sample size (n) = 36
Z-value for 95% confidence level = 1.96
First, calculate the standard error of the mean (SEM):
SEM= $\frac{SD}{\sqrt{n}}=\frac{6}{\sqrt{36}}=\frac{6}{6}=1$
Next, apply the confidence interval formula:
CI=$\underline{X} \pm z$ (SEM)
CI= 30 ± 1.96 × 1
CI= 30 ± 1.96
CI= 30−1.96 to 30 +1.96
CI= 28.04 to 31.96

3. **Correct Answer (C):** In population dynamics, the logistic growth model describes how a population grows in an environment with limited resources. The sequence of growth phases includes the Lag phase, where growth is slow as the population adapts to the environment; the Exponential phase, where growth accelerates rapidly as resources are abundant; and the Stationary phase, where growth stabilizes as resources become limited and the population reaches the environment's carrying capacity. The correct sequence is Lag phase → Exponential phase → Stationary phase (C), illustrating the transition from slow initial growth to rapid expansion and finally to equilibrium.



4. **Correct Answer (D):** The Leslie matrix population model is a demographic tool used to project the age distribution and growth of a population over time. It is named after Patrick Leslie, who developed it in 1945. The model uses a matrix to represent the survival rates and fertility rates of different age classes within a population. By repeatedly multiplying the initial population vector by the Leslie matrix, one can predict the future population size and age structure. It is particularly useful for understanding the dynamics of populations with overlapping generations. The model is not typically used to analyze prey-predator interactions, which are better studied using other models, such as the Lotka-Volterra equations.

5. **Correct Answer (B):**
ΔN_n: Production of new individuals in the population
Δt: Time interval
N: Initial number of individuals in the population
The natality rate is calculated by dividing the number of new individuals (ΔN_n) by the product of the initial population size (N) and the time interval (Δt). Hence, the formula is:
Natality rate= $\frac{\Delta N_n}{N\Delta t}$

6. **Correct Answer (B):** The natality rate is the rate at which new individuals are produced per unit population. To calculate this, we divide the number of new individuals produced (Nn) by the product of the initial population size (N) and the change in time (Δt). This gives us the rate of new individuals produced per individual per unit time.
ΔN_n: Production of new individuals in the population
Δt: Time interval
N: Initial number of individuals in the population
Natality rate= $\frac{\Delta N_n}{N\Delta t}$.

7. **Correct Answer (A):**
P (male being a smoker) = $\frac{Number\ of\ males\ who\ smoke}{Total\ number\ of\ males}$
Number of males who smoke = 38
Total number of males = 120
P(male being a smoker)= $\frac{38}{120}$
= 0.3167
≈0.32

8. **Correct Answer (A):** The standard error of the mean (SE) is a measure of how much the sample mean ($\underline{X}$) is expected to fluctuate from the true population mean. It is calculated using the sample standard deviation (SD) and the sample size (N):
SE= $\frac{SD}{\sqrt{N}}$
Given:

CHAPTER-10 CONTEMPORARY ENVIRONMENTAL ISSUE

Unit 10.1: Global Environmental Issues – Biodiversity loss, Climate change, Ozone layer depletion. Sea level rise. International efforts for environmental protection.

Previous Year Exam Questions

(DEC-2015)

1. With regard to ozone depletion over Antarctica, select the false statement

(A) Circumpolar vortex acts as a reaction chamber
(B) Polar Stratospheric Clouds (PSCs) are formed within the vortex
(C) There is very low temperature inside the vortex
(D) The heterogenous reaction $ClONO_2(s) + HCl(g) \rightarrow Cl_2(g) + HNO_3(s)$ takes over PSCs

(DEC-2015)

2. For providing information related to environment to decision makers, policy makers, scientists and environmental engineers all over the country, ENVIS was established in the year belonging to:

(A) Sixties (B) Seventies
(C) Eighties (D) Nineties

(DEC-2015)

3. The total radiative forcing of all major and minor green-house gases in the year 2014 is estimated to be:

(A) $\sim 2.51\ W/m^2$ (B) $\sim 2.93\ W/m^2$
(C) $\sim 1.87\ W/m^2$ (D) $\sim 2.7\ W/m^2$

(JULY-2016)

4. With respect to sea, increase in CO_2 abundance is not responsible for which of the following?

(A) Increase in pH of sea water.
(B) Increase in concentration of bicarbonate ions.
(C) Coral bleaching
(D) Enhanced dissolution of calcareous materials.

(JULY-2016)

5. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):

Assertion (A): Large parts of India have already become water stressed.
Reason (R): Climate change may be the main reason.
Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

(JULY-2016)

6. In addition to their role in ozone depletion, CFCs play a role in global warming by

(A) reducing the albedo of the earth's surface
(B) absorbing solar radiation
(C) blocking UV-B radiation on earth
(D) absorbing terrestrial radiation

(JULY-2016)

7. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):

Assertion (A): All cloud processes have implications for climate change.
Reason (R): Clouds strongly affect the flux of both shortwave and infra-red light through atmosphere.
Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

8. The corporate social responsibility has been made mandatory since

(A) 2010 (B) 2014
(C) 2015 (D) 2013

(JAN-2017)

9. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):

Assertion (A): Ozone depletion is much less over arctic stratosphere than over Antarctic stratosphere.
Reason (R): Antarctic atmosphere is on an average about $10^{\circ}C$ cooler than the arctic stratosphere.
Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false and (R) is true.

(JAN-2017)

10. In a city, the daily per capita inhalation (m^3) values of contaminated air over a period of 5 days are $6.3, 6.3, 6.2, 6.4$ and 5.8 , respectively. The sample mean with standard deviation of the data is

(A) 6.2 ± 0.02 (B) 6.2 ± 0.23
(C) 6.0 ± 0.15 (D) 6.2 ± 0.18

(JAN-2017)

11. For a sample size $n = 16$, the mean $(\underline{X})$ value and standard deviation (S) are found to be 5.667 and

0.934 , respectively. If the population mean is $\mu = 5.2$, then t-statistic is

(A) 0.5 (B) 0.47
(C) 1.76 (D) 2.0

(JAN-2017)

12. Consider the following statements about the ozone hole?

(I) Ozone formation and destruction keeps on happening.
(II) Ozone destruction rate is higher than its formation rate.
(III) Ozone destruction rate is equal to its formation rate.

Choose the correct answer:

(A) I only (B) I and II only
(C) I and III only (D) III only

(NOV-2017)

13. CRIEGEE intermediate is formed in which of the following atmospheric reactions?

(A) Olefin and Ozone
(B) Ethane and Ozone
(C) Acedaldehyde and Ozone
(D) NO_2 and Ozone

(NOV-2017)

14. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):

Assertion (A): Some infectious particles loose their infectious - ability in territories closer to equator, with high average of daily sunshine hours.

Reason (R): UV incidence can determine the survival of infectious particles.

Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false and (R) is true.

(JULY-2018)

15. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R)

Assertion (A): Ozone depletion in stratosphere causes melanoma.

Reason (R): Ozone is a gas which largely absorbs UV - A radiation.

Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

(JULY-2018)

16. Fringing reef generally develops:

(A) as a narrow band close to a shore.
(B) at some distance from the coast.
(C)as a ring around central lagoon.
(D) as a patch in the pelagic zone of the sea.

(JULY-2018)

17. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):

Assertion (A): Global shipping is a source of net cooling of atmosphere.

Reason (R): Ships are responsible for significant amounts of sulphur emissions.

Choose the correct answer:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

(JUNE-2019)

18. Match List-I (Ozone Depleting Substances)with List-II (Chemical Formulas):

List-I (Ozone Depleting Substances)	List-II (Chemical Formulas)
(a) CFC-12	(i) $CF_2\ CICFCI_2$
(b) CFC-113	(ii) $CCIF_2CF_3$
(c) CFC-114	(iii) CF_2CI_2
(d) CFC-115	(iv) $CF_2\ CICF_2CI$

Choose the correct answer from the options given below:

(A) a-iii, b-ii, c-i, d-iv (B) a-iii, b-i, c-ii, d-iv
(C) a-iii, b-i, c-iv, d-ii (D) a-iv, b-iii, c-ii, d-i

(JUNE-2019)

19. Ozone depleting potential is measured with reference to:

(A) CFC-11 (B) CFC-12
(C) HCFC-22 (D) CFC-113

(JUNE-2019)

20. Match List-I (Gases) with List-II (Measurement Techniques):

List-I (Gases)	List-II (Measurement Techniques)
(a) Ozone	(i) IR Absorption
(b) NOx	(ii) Pulsed Fluorescence
(c) SO_2	(iii) Chemiluminescence
(d) CO	(iv) Ultraviolet Absorption

Choose the correct answer from the options given below:

(A) a-i, b-ii, c-iii, d-iv (B) a-iv, b-iii, c-ii, d-i
(C) a-ii, b-iv, c-i, d-iii (D) a-iv, b-ii, c-iii, d-i

(DEC-2019)

21. Polar Stratospheric Clouds facilitate which of the following reactions in the development of ozone hole?

(A) $Cl_2 + hv \rightarrow 2Cl$
(B) $ClNO_3 + HCl \rightarrow Cl_2 + HNO_3$
(C) $ClO + NO_2 + M \rightarrow ClNO_3 + M$
(D) $Cl + O_3 \rightarrow ClO + O_2$

(JUNE-2020)

22. Given below are two statements: One is labelled as Assertion (A) and other is labelled as Reason (R)
Assertion (A): Some countries are immune to the impacts of climate change.
Reason (R): The net contribution of some countries is less than 1% towards the global CO_2 emissions as a whole.
In light of the above statements, choose the correct answer from the options given below:
(A) Both (A) and (R) are true and (R) is the correct explanation of (A)
(B) Both (A) and (R) are true, but (R) is NOT the correct explanation of (A)
(C) (A) is true, but (R) is false
(D) (A) is false, but (R) is true

(JUNE-2020)

23. Given below are two statements: One is labelled as Assertion (A) and other is labelled as Reason (R).
Assertion (A): Hydrofluorocarbons (HFCs) and hydro chlorofluorocarbon (HCFCs) are used as substitute compounds for chlorofluorocarbons (CFCs).
Reason (R): HCFCs and HFCs are quite susceptible to reaction with OH radicals in the troposphere.
In light of the above statements, choose the correct answer from the options given below:
(A) Both (A) and (R) are true and (R) is the correct explanation of (A)
(B) Both (A) and (R) are true, but (R) is NOT the correct explanation of (A)
(C) (A) is true, but (R) is false
(D) (A) is false, but (R) is true

(JUNE-2021)

24. Which of the following compounds has the least Ozone Depleting Potential?
(A) $CFC - 11$ (B) Halons
(C) HCFC (D) Methyl Bromide

Directions (Q. No. 25 to 29): Read the passage given below. Based on it answer the question.

According to a study published recently in the journal Nature Climate Change, while black carbon has a large effect on snow darkening and resultant melting of snow, dust particles transported from as far as Saudi Arabia that get deposited in the Western Himalayan Region (WHR) have a large role to play in melting of snow, particularly at higher elevations. Dust transported as elevated, aerosol layers get deposited at $1 - 5\ km$ elevations, black carbon emission is mostly a surface phenomenon and influences melting of snow from surface to about $3\ km$ elevation.

Based on remote sensing data of spatial distribution of dust aerosol concentration over the Indian subcontinent and dust-induced snow albedo reduction over Himalayas during the period 2011 2016 and simulations, it has been inferred that the relative impacts of dust and black carbon vary with surface elevation of snow pack. This is in addition to snow-melt caused by warming due to climate change. Earlier studies have shown that the magnitude of snow mass decrease is about $1\ mm$ per year at $1\ km$ elevation, about $5\ mm$ per year at $4.5\ km$ elevation and about $3\ mm$ per year at $6\ km$ elevation.

Though black carbon has a larger snow albedo darkening effect than dust due to a larger mass absorption efficiency, the study found that radiative effects of dust deposited on snow are comparable to black carbon in the WHR at higher elevations. This is mainly because the deposition of the dust by mass is $100 - 1000$ times more than black carbon. As the elevation increases, the influence of dust comes greater than black carbon and this coincides with maximum intensity of snow melt reduction seen at $3 - 5\ km$ elevation. Between these two black carbon mainly contributes to snow melt at lower elevation while dust is the major contributor for snow melt at higher elevation.

Westerlies transport dust particles as elevated aerosol layers at maximum intensities mostly during the pre-monsoon period and this gets deposited at higher elevations in the WHR.

Due to global warming, snow cover at lower elevations in the Himalayas will occur less frequently or totally disappear compared with snow cover at higher elevations. The annual contribution of dust to snow melt will therefore likely increase in future as the black carbon effect at lower elevation weakness with dwindling snow pack.

(JUNE-2021)

25. Snow melt in Himalayas is on account of:
(a) Dust deposition
(b) Black carbon deposition
(c) Increase in albedo
(d) Climate change
Codes:
(A) (a) and (b) only (B) (a),(b),(c) and (d)
(C) (a),(b) and (c) only (D) (a),(b) and (d) only

(JUNE-2021)

26. Maximum rate of snow mass reduction per annum is at elevation of:
(A) $1\ km$ (B) $3 - 5\ km$
(C) $6\ km$ (D) $2\ km$

(JUNE-2021)

27. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R):
Assertion (A): Reduction in snow albedo is more in case of black carbon than dust
Reason (R): Black carbon has higher mass absorption

efficiency compared to dust.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both (A) and (R) are true and (R) is the correct explanation of (A)
(B) Both (A) and (R) are true, but (R) is NOT the correct explanation of (A)
(C) (A) is true, but (R) is false
(D) (A) is false, but (R) is true

(JUNE-2021)

28. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R):

Assertion (A): Radiative effects of dust deposited on snow are comparable to black carbon in the WHR at higher elevations.

Reason (R): Both black carbon and dust darken the snow cover.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both (A) and (R) are true and (R) is the correct explanation of (A)
(B) Both (A) and (R) are true, but (R) is NOT the correct explanation of (A)
(C) (A) is true, but (R) is false
(D) (A) is false, but (R) is true

(JUNE-2021)

29. The passage clearly brings out the finding that:

(A) Black carbon causes global warming
(B) Dust causes global warming
(C) Dust modifies the radiative properties of snow cover to the same extent as black carbon
(D) Black carbon and dust are competing agents in melting of snow packs

(JUNE-2021)

30. Name the person, who launched the "Green Belt Movement" in Kenya, and got the Nobel Peace Prize:

(A) Wangari Maathai (B) Gehurd Ertl
(C) Koichi Tanaka (D) Ryojii Noyori

Question Nos. 31 to 35

Ice cores have yielded a long and detailed proxy record of Earth's past climate. Oxygen isotope analysis, trapped air bubbles, and atmospheric aerosol deposits within the layers of ice have offered information about past temperature and greenhouse gas concentrations, as well as cataclysmic events such as major volcanic eruptions. Of all the locations where ice cores have been extracted from glaciers, the most significant is probably Dome C in Antarctica. The Dome C climate record shows that the present concentration of CO, in the atmosphere is greater than at any time in the last 800,000 years, and that increases and decreases in global temperature are closely correlated with changes in CO2 concentration-with temperatures high when CO_2 concentrations are high, and vice versa. Further, the findings at Dome C closely match the proxy climate record derived from the nearby Vostok, Antarctica, ice core, as well as oxygen isotope analysis of foraminifera (tiny marine creatures) found in oceanic sediments, adding to the Scientists' confidence in the soundness of the Dome C data. Among the most interesting findings of the ice core analysis are from a period between about 400,000 and 650,000 years ago. Two of the warm interglacial periods that occurred during this time span were relatively mild compared to the interglacial periods of the last 400,000 years. Further, carbon dioxide and methane concentrations were lower during those two earlier interglacial periods than during more recent interglacial.

(JUNE 2024)

31. Which one of the following oxygen isotope ratio is used for past temperatures?

(A) O^{17}/O^{16} (B) O^{18}/O^{17}
(C) O^{18}/O^{16} (D) O^{16}/O^{18}

(JUNE 2024)

32. Foraminifera shells are made up of

(A) SiO_2 (B) $FeCO_3$
(C) $CaCO_3$ (D) $MgCO_3$

(JUNE 2024)

33. What is the present day partial pressure of CO, in the ambient atmosphere?

(A) ~ 0.00038 (B) ~ 0.0420
(C) - 0.0042 (D)- 0.00042

(JUNE 2024)

34. The findings of Dome C closely match the proxy climate record derived from the nearby Vostok ice core. Which law of stratigraphy applies for the correlation between layers of similar ages?

(A) Law of super position
(B) Law of horizontality
(C) Law of Lateral continuity
(D) Law of cross cutting relationship

(JUNE 2024)

35. The warm interglacial periods during 400,000 to 650,000 years occurred in the:

(A) Anthropocene (B) Holocene
(C) Pleistocene (D) Pliocene

(SEP-2024)

36. Which of the following is NOT linked to Biodiversity loss and ecosystem services?

(A) Intergovernmental Science-Policy platform for Biodiversity and Ecosystem Services (IPBES)
(B) Commission on Ecosystem Management (CEM)
(C) Millennium Ecosystem Assessment (MEA)
(D) The Economics of Ecosystem and Biodiversity (TEEB)

(SEP-2024)

37. Which one of the following is a green house gas and a criteria air pollutant under national ambient air

hole phenomenon observed in the stratosphere during polar spring. There are two types of PSCs, referred to as Type I and Type II PSC.

PSC I provides a catalytic surface for a heterogeneous reaction between $ClNO_3$ and HCl that leads to regeneration of active chlorine.

$$ClNO_3 + HCl \rightarrow Cl_2 + HNO_3 \quad and \; 2Cl + 2O_3 \rightarrow 2ClO + 2O_2.$$

22. Correct Answer (D): No country is immune to the impacts of climate change, as its effects are global and interconnected. While some countries may contribute less than 1% to global CO_2 emissions, they are still vulnerable to climate change impacts, such as sea-level rise, extreme weather events, and shifting ecosystems. The assertion that some countries are immune is false because climate change affects all regions, though the severity and type of impact may vary.

23. Correct Answer (A): HFCs and HCFCs are used as substitutes for CFCs because they do not deplete the ozone layer as significantly. The reason behind this is their susceptibility to react with hydroxyl radicals (OH) in the troposphere, causing them to break down before they can reach the stratosphere. This prevents them from releasing chlorine atoms that destroy ozone molecules. Therefore, both the assertion and the reason are correct, with the reason appropriately explaining why HFCs and HCFCs are preferred over CFCs.

24. Correct Answer (C): Hydrochlorofluorocarbons (HCFCs) have a lower ozone-depleting potential compared to other compounds like CFCs, halons, and methyl bromide. HCFCs contain hydrogen, making them less stable in the atmosphere and more likely to degrade before reaching the stratosphere, where they can cause ozone depletion.

25. Correct Answer (D): According to the passage, snow melt in the Himalayas is influenced by dust deposition (a), black carbon deposition (b), and climate change (d). Dust and black carbon contribute to snow melt through their effects on snow albedo, where dust deposition occurs at higher elevations and black carbon primarily affects lower elevations. Climate change also plays a significant role in reducing snow cover at lower elevations, leading to increased dust and black carbon impact on snow melt.

26. Correct Answer (B): The passage states that the maximum rate of snow mass reduction per year occurs at elevations of 3-5 km. This is where the influence of dust deposition is most pronounced, contributing significantly to snow melt due to its high deposition rates and effects on snow albedo.

27. Correct Answer (A): The passage confirms that black carbon has a larger snow albedo darkening effect than dust due to its higher mass absorption efficiency (Reason (R). This efficiency means black carbon absorbs more sunlight and heats the surrounding snow more effectively, thus reducing snow albedo more significantly than dust (Assertion (A).

28. Correct Answer (B): Both statements are true: the passage states that radiative effects of dust on snow are comparable to black carbon at higher elevations (Assertion (A). However, the reason (R) that both darken snow cover is not directly supported by the passage as the sole explanation for their radiative effects being comparable. Their comparable effects are due to different mechanisms (dust's high deposition and black carbon's absorption efficiency).

29. Correct Answer (D): The passage indicates that black carbon and dust have different impacts on snow melt depending on elevation. Black carbon affects lower elevations more, while dust has a greater impact at higher elevations due to its higher deposition rates. This competition between black carbon and dust in influencing snow melt dynamics is highlighted in the passage.

30. Correct Answer (A): Wangari Maathai, a Kenyan environmental and political activist, founded the Green Belt Movement in 1977. The movement focused on environmental conservation, tree planting, and women's rights, contributing significantly to sustainable development. Maathai's efforts earned her the Nobel Peace Prize in 2004, recognizing her contribution to sustainable development, democracy, and peace.

31. Correct Answer (C): The oxygen isotope ratio δO^{18} is commonly used in paleoclimatology to infer past temperatures. The ratio of oxygen-18 (O^{18}) to oxygen-16 (O^{16}) in ice cores and marine sediments reflects changes in temperature and ice volume. During colder periods, O^{16} is preferentially stored in ice sheets, leading to higher O^{18} values in ocean water and vice versa.

32. Correct Answer (C): Foraminifera are marine microorganisms that build their shells from calcium carbonate ($CaCO_3$). These shells accumulate in ocean sediments and serve as valuable proxies for reconstructing past ocean temperatures and

chemistry. The isotope composition of $CaCO_3$ in foraminifera shells is used to study past climatic conditions.

33. Correct Answer (B): The passage mentions that the present concentration of CO_2 in the atmosphere is greater than at any time in the last 800,000 years. The partial pressure of CO_2 currently stands at approximately 420 ppm, or 0.0420%, reflecting recent atmospheric measurements.

34. Correct Answer (C): The Law of Lateral Continuity states that layers of sediment initially extend laterally in all directions; in other words, they are laterally continuous. This law allows scientists to correlate layers of similar age between different locations, such as the Dome C and Vostok ice cores in Antarctica, ensuring that the findings from one core can be compared and matched with another.

35. Correct Answer (C): The Pleistocene Epoch spans from about 2.6 million to 11,700 years ago. The passage mentions that two warm interglacial periods occurred between 400,000 and 650,000 years ago, which places them within the Pleistocene Epoch. The Pleistocene is characterized by repeated glacial cycles, with interglacial periods of warmer climate conditions in between.

36. Correct Answer (B): The Commission on Ecosystem Management (CEM) is part of the International Union for Conservation of Nature (IUCN), which focuses on ecosystem management but is not specifically a major framework or initiative directly linked to the assessment of biodiversity loss and ecosystem services in the same way as IPBES, MEA, and TEEB are.

37. Correct Answer (D): Ozone (O3) is a greenhouse gas and a criteria air pollutant but is not directly emitted into the troposphere. It forms in the troposphere through reactions involving precursor pollutants like NOx and VOCs, making it a secondary pollutant.

38. Correct Answer (C): While **water vapor** is a significant greenhouse gas, **ozone** absorbs outgoing **terrestrial radiation** in the **longwave atmospheric window**. Ozone absorbs radiation in both the ultraviolet (UV) and infrared (longwave) regions of the electromagnetic spectrum. This process helps regulate Earth's energy balance by absorbing longwave radiation emitted from the Earth's surface and re-radiating it, contributing to the greenhouse effect.

- **Water vapor** (option 2) does absorb longwave radiation but it mainly works in the near-infrared region, and not specifically in the longwave atmospheric window.
- **Oxygen** and **Nitrogen dioxide** do not have significant roles in absorbing longwave radiation.

39. Correct Answer is (B):- Ozone formation requires nitrogen dioxide (NO_2), not nitric oxide (NO). Sunlight breaks down NO_2 to produce ozone. However, NO actively destroys ozone in a rapid reaction ($NO + O_3 \rightarrow NO_2 + O_2$). Therefore, a high concentration of NO compared to NO_2 would actually suppress and reduce ozone formation, not promote it. The other statements are accurate descriptions of atmospheric chemistry and smog composition.

40. Correct Answer (B): We arrange the countries in **increasing order of CO_2 emissions** (lowest → highest).

Approximate current annual CO_2 emissions

- **United Kingdom** ≈ very low among these (developed country, reduced coal use)
- **Russia**≈ moderate
- **India** ≈ high (rapid industrial growth)
- **China** ≈ highest in the world

41. Correct Answer is (B): Carbon dioxide is the largest contributor to anthropogenic warming among the gases listed because of its large emissions, long atmospheric persistence and strong overall radiative forcing. **CH_4:** Methane has a much stronger warming effect per molecule than CO_2, but its atmospheric concentration and total emissions are much lower. Consequently, its overall contribution is below CO_2. **O_3:** Tropospheric ozone is a greenhouse gas and contributes to warming. It is also a secondary pollutant, formed through atmospheric chemical reactions involving precursor gases such as NO_x and VOCs. **CFCs:** CFCs are extremely powerful greenhouse gases on a molecule-for-molecule basis, but their atmospheric concentrations are very low compared with CO_2 and CH_4. Their contribution to total anthropogenic warming is therefore smaller. **N_2O:** Nitrous oxide is a potent greenhouse gas with a long atmospheric lifetime, but its overall contribution to total anthropogenic warming is smaller than those listed above.

42. Correct Answer is (D): Warming near Peru and Ecuador: During El Niño, the normally cool eastern tropical Pacific becomes unusually warm. Warm surface water moves eastward toward the coasts of Peru and Ecuador. Normally, cold, nutrient-rich water rises along the western coast of South America

due to upwelling. During El Niño, this upwelling is weakened, causing sea-surface temperatures to rise.
Walker circulation weakens/reverses: Under normal conditions, the Walker circulation has rising air and convection over the western Pacific and sinking air over the eastern Pacific. During a strong El Niño, this atmospheric circulation is weakened and can become reversed, with convection shifting toward the central/eastern Pacific.

Unit 10.2: National Action Plan on Climate Change (Eight National missions –National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for a 'Green India', National Mission for Sustainable Agriculture, National Mission on Strategic Knowledge for Climate Change).

Previous Year Exam Questions

(DEC 2015)

1. **According to MOEF (now MOEFCC) notification of 1992, for labelling cosmetics as environment friendly product, the presence of fluoride (F) in tooth paste/powder should not exceed:**
(A) $20ppm$ (B) $50ppm$
(C) $100ppm$ (D) $10ppm$

(NOV-2017)

2. **Which country has opted out of Paris Agreement on climate change?**
(A) USA (B) Canada
(C) Australia (D) Russia

(JUNE-2019)

3. **Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):**
Assertion (A): In the Himalayas north-facing slopes have luxuriant growth of forests, whereas shruby drought-resistant vegetation inhabits the south-facing slopes.
Reason (R): South-facing slopes in the northern hemisphere receive more sunlight than nearby north-facing slopes and, therefore, are warmer and drier.
Choose the correct answer from the options given below.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A)
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)
(C) (A) is true, but (R) is false
(D) (A) is false, but (R) is true

(SEP-2022)

4. **LEED, one of the Sustainable Habitat green rating systems, refers to:**
(A) Leadership in Energy and Efficiency Design
(B) Leadership in Energy and Environment Design
(C) Leadership in Energy and Environment Design
(D) Leadership in Energy and Environment Document

(MAR-2023)

5. **How many National Missions form the core of the National Action Plan on Climate Change (NAPCC) to focus on promoting understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation?**
(A) $Six\ (6)$ (B) Fight (8)
(C) Ten (10) (D) Twelve (12)

(MAR-2023)

6. **Which of the following are covered under the National Mission for Sustaining the Himalayan Ecosystem?**
(a) Himalayan Glaciers
(b) Institutional Capacities
(c) Biodiversity Conservation
(d) Wildlife Conservation
(e) Traditional Knowledge
Choose the correct answer from the options given below:
(A) (a),(b),(c) and (d) only
(B) (b), (c),(d) and (e) only
(C) (a),(b),(c),(d) and (e)
(D) (a),(c),(d) and (e) only

(SEP-2024)

7. **Which among the following National Mission under National Action Plan of Climate change are taken care of under the Department of Science and Technology (DST)?**
a. Enhanced Energy Efficiency
b. Sustaining the Himalayan Ecosystem
c. Sustainable Agriculture
d. Strategic Knowledge for climate change
e. Sustainable Habitat
Choose the most appropriate answer from the options given below:
(A) a and c Only (B) b and d Only
(C) c and e Only (D) a and e Only

(SEP-2024)

8. **Which of the following is portal by MoEFCC, Government of India to automate the process of Environmental Clearance?**
(A) ELACP (B) ENVIS
(C) e Green watch (D) PARIVESH

(JAN-2025)

9. **Which of the following factor(s) is/are used to calculate global warming potential of greenhouse gases?**
(a) Concentration
(b) Spectral window
(c) Atmospheric lifetime
(d) Absorption efficiency
Choose the correct answer from the options given below:

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

(JAN-2025)

10. Arrange the following greenhouse gases in decreasing order of their concentration (by volume) in the Earth's atmosphere up to an altitude of 100 km.

(a) Ozone (b) Carbon dioxide
(c) Methane (d) Nitrous oxide

Choose the correct answer from the options given below:

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

(JUNE 2025)

11. National Mission for a Green India (GIM) is one of the eight missions under National Action Plan on Climate Change. Which of the following is NOT listed as an aim of Green India Mission for forest cover and response to climate change?

(A) Conservation (B) Enhancement
(C) Protection (D) Restoration

(JUNE2026)

12. Which of the following are part of National Action Plan for Climate Change in India?

A. National Water Mission
B. National Solar Mission
C. National Mission for Enhanced Energy Efficiency
D. National Mission on Sustaining the Himalayan Ecosystem
E. National Mission on Green Hydrogen

Choose the correct answer from the options given below:

(A) B, C and E only (B) A, B, C and D only
(C) A, B, C and E only (D) B, C, D and E only

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
D	A	A	C	B	C	B	D	D	C
11	**12**								
A	B								

EXPLANATION

1. Correct Answer (D): According to the Ministry of Environment and Forests (MOEF), now Ministry of Environment, Forest and Climate Change (MOEFCC), notification of 1992, for labeling cosmetics as environment-friendly products, the presence of fluoride (F) in toothpaste or powder should not exceed, 50ppm. The 1992 notification set a maximum limit of 50 parts per million (ppm) for fluoride content in toothpaste or powder to ensure environmental safety and reduce potential harmful effects.

2. Correct Answer (A): The United States' decision to opt out of the Paris Agreement in 2017 drew international attention. This agreement aims to combat climate change by limiting global warming and reducing greenhouse gas emissions. The U.S. withdrawal has implications for global climate efforts and international cooperation on environmental issues.

3. Correct Answer (A): In the Himalayas, the orientation of slopes influences vegetation due to sunlight exposure. South-facing slopes receive more direct sunlight, leading to higher temperatures and drier conditions, favoring drought-resistant vegetation. In contrast, north-facing slopes receive less direct sunlight, resulting in cooler and moisture conditions that support luxuriant forest growth. Thus, the difference in solar radiation exposure explains the vegetation patterns observed in the Himalayan slopes.

4. Correct Answer (C): LEED (Leadership in Energy and Environmental Design) is a globally recognized green building certification system that provides a framework for sustainable building design, construction, and operation. It promotes energy efficiency, water conservation, and environmental sustainability in building projects worldwide, encouraging the adoption of green building practices and technologies.

5. Correct Answer (B): The National Action Plan on Climate Change (NAPCC) comprises eight national missions focusing on climate change mitigation and adaptation, energy efficiency, and natural resource conservation. These missions include the National Solar Mission, National Mission for Enhanced Energy Efficiency, and others aimed at promoting sustainable practices and reducing greenhouse gas emissions. The NAPCC provides a strategic framework for addressing climate change challenges and integrating climate considerations into national development planning, enhancing India's resilience to climate impacts.

6. Correct Answer (C): The National Mission for Sustaining the Himalayan Ecosystem aims to address various aspects crucial for preserving the delicate Himalayan ecology. It covers Himalayan glaciers, which are vital water sources, institutional capacities to enhance research and conservation efforts, biodiversity conservation to protect the unique flora and fauna, wildlife conservation to safeguard animal populations, and traditional knowledge to integrate indigenous practices into modern conservation

strategies. This comprehensive approach ensures the long-term sustainability of the Himalayan ecosystem amid climatic and anthropogenic pressures.

7. **Correct Answer (B):** Under the National Action Plan on Climate Change (NAPCC), the Department of Science and Technology (DST) is responsible for the National Missions on Sustaining the Himalayan Ecosystem and Strategic Knowledge for Climate Change . The other missions, such as Enhanced Energy Efficiency and Sustainable Agriculture, fall under different departments.

8. **Correct Answer (D):** The portal by the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, to automate the process of Environmental Clearance is, PARIVESH.

9. **Correct Answer (D):** The **Global Warming Potential (GWP)** of a greenhouse gas is calculated using multiple factors that determine its effectiveness in trapping heat in the atmosphere relative to carbon dioxide (CO_2). These factors include:

(a) **Concentration**: The amount of the gas present in the atmosphere influences its warming potential.
(b) **Spectral window**: The specific wavelengths of infrared radiation the gas can absorb, affecting its ability to trap heat.
(c) **Atmospheric lifetime**: The time a greenhouse gas stays in the atmosphere before it breaks down or is removed, contributing to its cumulative effect on warming.
(d) **Absorption efficiency**: How efficiently the gas absorbs and re-emits infrared radiation, influencing its contribution to the greenhouse effect.

10. **Correct Answer (C):** The concentration of greenhouse gases in the Earth's atmosphere decreases with altitude. Up to **100 km**, the typical order of concentration by volume is:

(b) **Carbon dioxide (CO_2)**: It has the highest concentration among greenhouse gases in the atmosphere, especially at lower altitudes.
(c) **Methane (CH_4)**: Present in lower concentrations than CO_2, but still significant.
(d) **Nitrous oxide (N_2O)**: Has a lower concentration than methane.
(a) **Ozone (O_3)**: While ozone is important for absorbing UV radiation, its concentration is much lower compared to CO_2 and methane, and it is mostly found in the stratosphere, with its concentration decreasing with altitude.

11. **Correct Answer is (A):-** The National Mission for a Green India (GIM) focuses on addressing climate change through forest-based strategies. Its core aims include protection, restoration, and enhancement of forest cover, rather than explicitly emphasizing conservation. The mission prioritizes active restoration and enhancement over conservation alone to improve forest ecosystems.

12. **Correct Answer is (B):** The **National Action Plan on Climate Change (NAPCC)** was launched by the Government of India in **2008**. It originally consisted of **eight National Missions** designed to address climate-change mitigation and adaptation.

Explanation of each statement			
Statement	**Mission**	**Part of NAPCC?**	**Explanation**
A	National Water Mission	**Yes**	One of the original eight NAPCC missions. It focuses on **water conservation, water-use efficiency, and sustainable water management**.
B	National Solar Mission	**Yes**	One of the original eight missions. It promotes **solar energy development and deployment** to reduce dependence on fossil fuels.
C	National Mission for Enhanced Energy Efficiency	**Yes**	One of the original eight missions. It promotes **energy efficiency and reduction in energy consumption**.
D	National Mission on Sustaining the	**Yes**	One of the original eight missions. It focuses on understanding

	Himalayan Ecosystem		and protecting the **Himalayan ecosystem under climate change**.
E	National Mission on Green Hydrogen	**No**	The **National Green Hydrogen Mission** is a later initiative, approved in **2023**, and is **not one of the original eight NAPCC missions**.

Unit 10.3: 'Green India', National Mission for Sustainable Agriculture, National Mission on Strategic Knowledge for Climate Change).

Previous Year Exam Questions

(JULY-2016)

1. In soil conservation programme, the tillage where residues of previous crops are left in the soil is called
(A) Reduced tillage (B) No tillage
(C) Conservation tillage (D) Contour plowing

(NOV-2017)

2. Given below are two statements. One labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): Climate change induced monsoon variability may have serious consequences for Indian agriculture.
Two third ($2/3rd$) of area under cultivation in India is rain dependent.
Choose the correct answer:
(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false and (R) is true.

(JUNE-2020)

3. Which of the following does NOT fall under the major goals of the National Mission for Green India?
(A) To increase forest/tree cover to the extent of five million llectares:
(B) To improve /enhance eco-system services like carbon sequestration and storage, hydrological services and biodiversity.
(C) To increase forest-based livelihood income of about three million households.
(D) To study the traditional knowledge systems for community participation in adaptation and mitigation strategies.

(JUNE-2020)

4. Under the GRIHA Rating Norms, a building securing 57 points on a 100 point scale, will be assigned which of the following star ratings
(A) Two star (B) Three star
(C) Four star (D) Five star

(SEP-2022)

5. 'Prerak Dauur Samman', the annual award given under which of the following scheme of Government of India?
(A) Smart Cities
(B) Namami Gange.
(C) Swachh Bharat Abhiyan
(D) Green India Mission

(MAR-2023)

6. Who led the work of TARUN BHARAT SANGH which made water available round the year in the wells?
(A) Anna Hazare
(B) Chandi Prasad Bhatt
(C) Rajendra Singh
(D) undar Lal Bahuguna

(SEP-2024)

7. Arrange the following criterion of GRIHA: 2019 in increasing order of points allotted.
a. Energy optimization
b. Green Infrastructure
c. Maintaining good IAQ
d. Top Soil Preservation
e. Water Demand Reduction
Choose the most appropriate answer from the options given below:
(A) a, c, b, e, d (B) d, c, b, e, a
(C) c a, b, e, d (D) d, e, b, c, a

Answer Key						
1	**2**	**3**	**4**	**5**	**6**	**7**
C	A	D	B	A	C	D

EXPLANATION

1. Correct Answer (C): Conservation tillage refers to any method of soil cultivation that leaves the previous year's crop residue on fields before and after planting the next crop. This practice helps to reduce soil erosion, improve soil health by increasing organic matter, and conserve moisture.

2. Correct Answer (A): India's agriculture heavily depends on the monsoon, which is becoming increasingly erratic due to climate change. This variability affects crop yields, water availability, and farmer livelihoods across the country. India's rain-fed

agriculture covers a substantial portion of its cultivated land, highlighting the critical role of monsoons in sustaining agricultural productivity.

3. **Correct Answer (D):** The National Mission for Green India is part of India's National Action Plan on Climate Change, aiming to enhance ecosystem services, increase forest and tree cover, and improve forest-based livelihoods. It does not include studying traditional knowledge systems for community participation in adaptation and mitigation strategies. Instead, it focuses on increasing forest cover to five million hectares, enhancing carbon sequestration, improving hydrological services, and boosting biodiversity to meet climate goals and support sustainable development.

4. **Correct Answer (B):** GRIHA (Green Rating for Integrated Habitat Assessment) is India's national rating system for green buildings. Buildings are rated on a 100-point scale based on their environmental performance. A building securing 57 points on this scale would be assigned a three-star rating. This rating reflects the building's adherence to sustainable design and construction practices, energy efficiency, water conservation, waste management, and indoor environmental quality.

5. **Correct Answer (A):** 'Prerak Dauur Samman' is an annual award given under the Smart Cities Mission of the Government of India. It recognizes and incentivizes cities and urban local bodies that demonstrate innovation, best practices, and significant achievements in improving urban cleanliness and solid waste management under the Swachh Bharat Mission.

6. **Correct Answer (C):** Rajendra Singh, known as the "Waterman of India," led the efforts of Tarun Bharat Sangh, a non-governmental organization focused on water conservation and management. Through community-led initiatives like rainwater harvesting and watershed development, Singh's work made water available year-round in wells, transforming arid regions and improving agricultural productivity.

7. **Correct Answer (D):**
- Top Soil Preservation: This criterion typically receives the fewest points.
- Water Demand Reduction: While important, water demand reduction is usually prioritized less than other criteria.
- Green Infrastructure: Green infrastructure, such as green roofs and rainwater harvesting, is valued but may not have the highest point allocation.
- Maintaining good IAQ: Indoor air quality is considered crucial for occupant health and well-being, so it often receives a higher point value.
- Energy optimization: Energy efficiency is a key aspect of sustainable building design, so it typically has the highest point allocation in GRIHA 2019.

Unit 10.4: Current Environmental Issues in India: Environmental issues related to water resource projects - Narmada dam, Tehri dam, Almatti dam, Cauvery and Mahanadi, Hydro-power projects in Jammu & Kashmir, Himachal and North-Eastern States.

Previous Year Exam Questions

(JULY-2018)

1. **Battelle - Columbus environmental evaluation system is used to assess the impact of:**
(A) Mining development projects.
(B) Pulp and paper mill projects.
(C) Water resources projects.
(D) Highway projects.

(JUNE-2019)

2. **Major environmental impacts of the Tehri dam in the Central Himalaya are:**
(a) Submergence of fertile agricultural lands
(b) Reservoir-induced seismicity
(c) Increased incidences of landslides in the reservoir rim
(d) Loss of biodiversity
Choose the correct option:
(A) (a) and (b) only (B) (a) and (c) only
(C) (a) and (d) only (D) (a),(b),(c) and (d)

(JUNE-2020)

3. **A small hydropower station based on the conversion of the kinetic energy of a river water generates power. If the flow of water is $10\ m^3\ s^{-1}$ and the speed of water is $3\ ms^{-1}$, what is the maximum power the station can generate? (Assume efficiency of the power station to be 0.6)**
(A) $18\ kW$ (B) $27\ kW$
(C) $36\ kW$ (D) $45\ kW$

(JUNE-2020)

4. **What is the maximum period valid for granting Environmental Clearance (EC) for mining project**
(A) 30 Years (B) 10 Years
(C) 5 Years (D) 20 Years

(JUNE-2021)

5. **Match List-I with List-II.**

List-I (Hydropower projects)	List-II (River)
(a) Sardar Sarovar project	(i) Bhagirathi River
(b) Tehri Dam project	(ii) Narmada River
(c) Pong dam	(iii) Mahanadi River
(d) Hirakund Dam	(iv) Beas River