DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

T.B.C. : STS-K-TPT
Serial No.:

Test Booklet Series

B

TEST BOOKLET

Subject : Test 8 – ENVIRONMENT & ECOLOGY
Answer Key

Time Allowed : Two Hours **Maximum Marks : 200**

INSTRUCTIONS

1.IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GOT IT REPLACED BY A COMPLETE TEST BOOKLET.

2. Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.

3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. DO NOT write anything else on the Test Booklet.

4. This Test Booklet contains 100/80 items (questions). Each item is printed in English. Each item comprises of four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each item.

5. You have to mark all your responses ONLY on the separate Answer Sheet provided. See directions in the Answer Sheet.

6. All items carry equal marks

7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.

8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator only the Answer Sheet. You are permitted to take away with you the Test Booklet.

9. Sheets for rough work are appended in the Test Booklet at the end.

10. **Penalty for wrong answers:**

THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS

(i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one third** if the marks assigned to that question will be deducted as penalty.

(ii) If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct and there will be same penalty as above to that question.

(iii) If a question is left blank, i.e., no answer is given by the candidate, there will be no penalty for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

Match the following unconventional hydrocarbon resources with their

1. Bioaccumulation refers to the gradual build-up of toxic substances in the tissues of living organisms over time. Which of the following is the best example illustrating the concept of **bioaccumulation**?

(a) A vulture feeding on multiple carcasses in its habitat.

(b) A deer migrating from one forest to another in search of food.

(c) Mercury storing in the tissues of a tuna fish over its lifespan due to contaminated water.

(d) A honeybee collecting nectar from flowers and pollinating plants in the process.

Correct Answer:

(c) Mercury accumulating in the tissues of a tuna fish over its lifespan due to contaminated water.

Explanation:

Bioaccumulation occurs when a chemical or toxin (such as heavy metals or pesticides) **accumulates in the body of an organism over time**, often because it is absorbed faster than it is broken down or excreted.

- **Option (c) is correct** :
  - Mercury pollution in water bodies enters the food chain.
  - Tuna fish **continuously absorb mercury** from water and from consuming smaller contaminated fish.
  - Over time, mercury levels **increase in the tuna's body tissues**, illustrating **bioaccumulation**.
- **Option (a) is incorrect** : While vultures feed on multiple carcasses, this does not illustrate **gradual toxin accumulation** within their bodies over time.
- **Option (b) is incorrect** : Migration is a behavioral response to environmental changes, not a process of toxin buildup in organisms.
- **Option (d) is incorrect** : Pollination is an ecological interaction, not an example of toxic substance accumulation.

2. In an ecosystem, energy flows from producers to consumers through different trophic levels. Which of the following is the best example illustrating this energy transfer?

(a) A sunflower turning towards the sunlight for photosynthesis.

(b) A snake using its camouflage to avoid predators.

(c) A grasshopper feeding on grass, and a frog preying on the grasshopper

(d) A bear hibernating during winter to conserve energy.

Correct Answer:

(c) A grasshopper feeding on grass, and a frog preying on the grasshopper.

Explanation:

The **flow of energy** in an ecosystem follows the **food chain**, starting from **producers (autotrophs)** and moving up to different levels of **consumers (herbivores, carnivores, and top predators)**.

- **Option (a) is correct** : This describes a classic **energy transfer** –
  - **Grass (Producer)** absorbs solar energy via photosynthesis.
  - **Grasshopper (Primary Consumer)** eats grass, gaining energy.
  - **Frog (Secondary Consumer)** preys on the grasshopper, transferring energy further up the chain.
- **Option (b) is incorrect** : Camouflage is an adaptation for survival, not an example of energy flow.
- **Option (c) is incorrect** : Sunflower's movement towards sunlight (phototropism) helps photosynthesis but does not illustrate energy transfer through trophic levels.

Option (d) is incorrect : Hibernation conserves energy but does not describe the flow of energy through food chains.

3. **Dead zones, also known as hypoxic zones, are increasingly observed in coastal and marine ecosystems due to human-induced nutrient pollution. In this context, which of the following best describes a "Dead Zone" in the ocean?**
(a) Regions of the ocean that are inaccessible to humans
(b) Areas where ocean currents and biological activity are absent
(c) Marine zones where dissolved oxygen levels are extremely low, making it difficult for most aquatic organisms to survive
(d) Regions dominated by large marine predators that feed on other organisms

---

✅ **Correct Answer**
(c) Marine zones where dissolved oxygen levels are extremely low

---

🧾 **Brief Answer Key**
Option (c): Correct — Dead zones are areas with **severely depleted dissolved oxygen (hypoxia)**, leading to mass mortality or migration of marine organisms.
Other Options: Incorrect — Dead zones are related to **oxygen depletion**, not inaccessibility, lack of movement, or predator concentration.

Dead zones generally form due to **eutrophication**, where excess nutrients (nitrogen and phosphorus) from:

- Agricultural fertilizer runoff
- Sewage discharge
- Industrial effluents

cause **algal blooms**. When algae die and decompose, oxygen is consumed, creating hypoxic conditions.
Major examples often cited in global environmental studies include:

- **Gulf of Mexico Dead Zone**
- **Baltic Sea** hypoxic regions

4. **In an ecosystem, abiotic components refer to the non-living physical and chemical factors that influence the structure and functioning of biological communities. In this context, consider the following:**

1. Water
2. Insolation (solar radiation)
3. Winds
4. Decomposers
5. Soil

Which of the above are **abiotic components** of an ecosystem?
Options:
(a) 1 and 5 only
(b) 1, 2, 3 and 5 only
(c) 2, 3 and 4 only
(d) 1, 3, 4 and 5 only

✅ **Correct Answer**
(b) 1, 2, 3 and 5 only

🧾 **Brief Answer Key**
1. Water: Abiotic — A physical environmental factor influencing ecosystems.
2. Insolation: Abiotic — Solar radiation drives **photosynthesis and climate processes**.
3. Winds: Abiotic — Affect temperature, moisture, seed dispersal, and weather patterns.
4. Decomposers: Not abiotic — They are **biotic organisms** (bacteria and fungi).
5. Soil: Abiotic — Provides minerals and physical substrate for plant growth.

5. **Plants are often classified based on their adaptations to environmental moisture conditions and ecological niches. In this context, consider the following statements:**

1. **Epiphytes** are non-parasitic plants that grow on other plants mainly for physical support.
2. **Xerophytic plants** require large quantities of water to survive in their habitat.
3. **Mesophytes** are terrestrial plants adapted to environments that are neither excessively dry nor excessively wet.

Which of the statements given above is/are correct?

Options:

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

✅ **Correct Answer**

(c) 1 and 3 only

🧻 **Brief Answer Key**

Statement 1: Correct — Epiphytes (e.g., orchids) grow on host plants **without deriving nutrients from them**.

Statement 2: Incorrect — Xerophytes are **adapted to arid environments** and possess features such as thick cuticles and reduced leaves to conserve water.

Statement 3: Correct — Mesophytes thrive in **moderate moisture conditions** typical of many terrestrial ecosystems.

6. **With reference to the hierarchy of ecological organization, consider the following sequence representing increasing levels of biological complexity:**

(a) Organism → Community → Population → Ecosystem → Biome → Biosphere
(b) Organism → Population → Community → Ecosystem → Biome → Biosphere
(c) Population → Organism → Ecosystem → Community → Biome → Biosphere
(d) Organism → Ecosystem → Population → Biome → Community → Biosphere

Which of the above correctly represents the **ascending order of ecological organization from the smallest unit to the largest?**

✅ **Correct Answer: (b) Organism → Population → Community → Ecosystem → Biome → Biosphere**

Explanation

The **correct sequence** of ecological organization from **simplest to most complex** is:

1. **Organism** – A single living being (**e.g., a tiger**).
2. **Population** – A group of individuals of the **same species** in a specific area (**e.g., a herd of elephants**).
3. **Community** – All **populations** of different species living in an area (**e.g., lions, deer, and trees in a forest**).
4. **Ecosystem** – Interaction of **biotic (living) and abiotic (non-living) components** in a specific area (**e.g., forest ecosystem with trees, animals, rivers, and soil**).
5. **Biome** – A **large geographical area** with a specific climate and life forms (**e.g., Rainforest, Desert**).
6. **Biosphere** – The **global sum of all ecosystems** (**Earth's entire lifesupporting environment**).

7. Adaptation enables organisms to survive and reproduce in specific environmental conditions. In this context, consider the following pairs:

Type of Adaptation	Example
1. Structural adaptation	Development of sharp claws in predatory birds such as eagles for capturing prey
2. Physiological adaptation	Production of antifreeze proteins in Arctic fish to prevent freezing
3. Behavioural adaptation	Ability of the kangaroo rat to remain in burrows and store food to survive extreme desert temperatures
4. Mimicry (protective adaptation)	Ability of octopuses to change colour and texture to blend with surroundings

Which of the pairs given above are correctly matched?

(a) 1 and 3 only
(b) 2, 3 and 4 only
(c) 1, 2 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer: (d) 1, 2, 3 and 4**

🧻 **Brief Answer Key**

1. Structural adaptation: Correct — Physical features like **claws, beaks, thorns, or thick fur** help organisms survive.
2. Physiological adaptation: Correct — Internal biochemical processes such as **antifreeze proteins in polar fish** or **CAM photosynthesis in desert plants**.
3. Behavioural adaptation: Correct — **Burrowing, migration, hibernation, and nocturnal activity** help organisms cope with environmental stress.
4. Mimicry / protective adaptation: Correct — **Camouflage or mimicry** helps organisms avoid predators or capture prey (e.g., octopus colour change). **Stick insect / leaf insect resemblance** → Mimicry

8. **With reference to the hierarchy of ecological organization, consider the following statements:**

1. A **biome** consists of several ecosystems that share broadly similar **climatic conditions and dominant vegetation**.
2. A **population** refers to different species interacting with each other within a defined geographical area.
3. An **ecosystem** includes interactions only among the **biotic components** within a given area.
4. The **biosphere** represents the highest level of ecological organization, encompassing all ecosystems and the interactions of living organisms with the **atmosphere, hydrosphere, and lithosphere**.

Which of the statements given above is/are correct?
(a) 1 and 4 only
(b) 1, 2 and 3 only
(c) 1, 3 and 4 only
(d) 2 and 3 only

✅ **Correct Answer: (a) 1 and 4 only**

🪨 **Brief Answer Key**
Statement 1: Correct — A **biome** is a large ecological region consisting of **multiple ecosystems with similar climate and vegetation patterns** (e.g., tundra, desert, tropical rainforest).
Statement 2: Incorrect — A **population** consists of **individuals of the same species** living in a particular area. Interaction among multiple species forms a **community**.
Statement 3: Incorrect — An **ecosystem includes both biotic (living organisms) and abiotic components (soil, water, air, climate)** interacting together.
Statement 4: Correct — The **biosphere** represents the **global ecological system integrating all living beings and their relationships with Earth's physical environment**.

9. **With reference to the concept of "Flagship Species" in biodiversity conservation, consider the following statements:**

1. A flagship species is a **species chosen to represent and promote conservation efforts for a particular habitat or environmental cause**.
2. The selection of a flagship species is often based on its **charisma, public appeal, or cultural significance** to attract public support.
3. A flagship species is necessarily the **top predator of the ecosystem** and must occupy the highest trophic level.

Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

✅ **Correct Answer: (a) 1 and 2 only**

🪨 **Brief Answer Key**
Statement 1: Correct — Flagship species are used as **symbols to mobilize conservation awareness and funding**.
Statement 2: Correct — They are often **charismatic or culturally important species** that attract public attention.
Statement 3: Incorrect — Flagship species **do not need to be apex predators**; they are chosen primarily for **public appeal rather than ecological role**.

Term	Meaning	Example

Flagship Species	Species used to promote conservation campaigns	Giant Panda (WWF), Bengal Tiger
Keystone Species	Species with disproportionate ecological impact	Sea otter, Tiger
Umbrella Species	Species whose protection safeguards many others	Tiger, Elephant
Indicator Species	Species indicating environmental health	Lichens

10. **With reference to cloud seeding as a weather modification technique, consider the following statements:**

1. Cloud seeding involves dispersing substances such as **silver iodide, potassium iodide, or dry ice** into clouds to enhance precipitation.
2. The technique is used to **induce rainfall, reduce hail damage, or disperse fog in airports** under suitable atmospheric conditions.
3. Cloud seeding can **create rain in completely cloudless skies** by artificially forming clouds.

Which of the statements given above is/are correct?
(a) 1 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1, 2 and 3

✅ **Correct Answer: (b) 1 and 2 only**

🪨 **Brief Answer Key**
Statement 1: Correct — Chemicals like **silver iodide, potassium iodide, and dry ice** act as **nuclei around which water droplets or ice crystals form**, encouraging precipitation.
Statement 2: Correct — Cloud seeding is used for **rain enhancement, hail suppression, and fog dispersal**, particularly in drought-prone regions and airports.
Statement 3: Incorrect — Cloud seeding **cannot create clouds**; it only **enhances precipitation in existing clouds** with sufficient moisture.

- In **2023–2024**, cloud seeding trials were discussed in cities like **Delhi** to address severe **air pollution episodes** by inducing rainfall.
- The technique works best with **cumulus or cold clouds** containing sufficient moisture.

Process	Meaning
Cloud Seeding	Enhancing rainfall in existing clouds
Artificial Rain	Informal term often used for cloud seeding
Fog Seeding	Clearing fog near airports

11. **Parasitoidism is a biological interaction in which the parasite ultimately kills its host as part of its life cycle. Parasitoids are typically insects whose larvae develop on or inside a host organism, consuming it until death. In this context, consider the following host–parasite pairs:**

1. **Ichneumon wasp – Caterpillars**
2. **Emerald cockroach wasp – Cockroach**
3. **Screw-worm fly – Livestock**
4. **Tick – Mammals**

Which of the above represent examples of **parasitoidism**?
Options:
(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(b) 1, 2 and 3 only

🪨 **Brief Answer Key**
1. Ichneumon wasp – Caterpillars: Correct — The wasp lays eggs inside caterpillars; the larvae **consume the host and eventually kill it**.
2. Emerald cockroach wasp – Cockroach: Correct — The wasp **paralyzes the cockroach and lays eggs on it**; larvae feed on the host, leading to its death.
3. Screw-worm fly – Livestock: Correct — Larvae infest wounds of animals and **feed on living tissue**, often killing the host.
4. Tick – Mammals: Incorrect — Ticks are **ectoparasites** that feed on blood but **generally do not kill the host as part of their life cycle**.

Interaction Type	Key Feature	Example
Parasitoidism	Parasite eventually kills host	Ichneumon wasp
Parasitism	Parasite harms but usually does not kill host	Tick
Brood parasitism	Host raises parasite offspring	Cuckoo bird
Kleptoparasitism	Stealing food from other species	Frigate birds

12. **Brood parasitism is a reproductive strategy in which one species lays its eggs in the nest of another species, relying on the host to incubate the eggs and raise the offspring, often to the detriment of the host's own young. In this context, consider the following host–parasite pairs:**

1. **Common cuckoo (*Cuculus canorus*) – Warblers**
2. **Honeyguide (*Indicator indicator*) – Other bird species**
3. **Cowbird (*Molothrus* spp.) – Other songbirds**
4. **Frigate bird – Seabirds**

Which of the above represent examples of **brood parasitism**?

Options:

(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**

(b) 1, 2 and 3 only

📜 **Brief Answer Key**

1. Common cuckoo – Warblers: Correct — The cuckoo lays eggs in the nests of warblers; the host incubates and raises the chick.
2. Honeyguide – Other birds: Correct — Honeyguides lay eggs in nests of other birds; their chicks often **kill host chicks after hatching**.
3. Cowbird – Songbirds: Correct — Cowbirds are **obligate brood parasites**, laying eggs in nests of multiple host bird species.
4. Frigate bird – Seabirds: Incorrect — Frigate birds practice **kleptoparasitism (stealing food)** rather than brood parasitism.

13. **Invasive alien species (IAS) are non-native organisms introduced into an ecosystem where they establish themselves, spread rapidly, and often disrupt native biodiversity and ecosystem functions. In this context, consider the following species:**

1. **Prosopis juliflora** – A drought-resistant tree introduced in India that often outcompetes native vegetation and alters soil and groundwater conditions.
2. **African catfish (*Clarias gariepinus*)** – A highly predatory fish species known to threaten native freshwater biodiversity.
3. **Snow trout (*Schizothorax* spp.)** – A fish species naturally occurring in Himalayan river systems.
4. **Papaya mealybug (*Paracoccus marginatus*)** – An invasive pest that damages papaya and several other crops.

Which of the above are considered **invasive species in India**?

Options:

(a) 1 and 2 only
(b) 1, 2 and 4 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**

(b) 1, 2 and 4 only

📜 **Brief Answer Key**

1. Prosopis juliflora: Correct — An introduced tree species that spreads aggressively and suppresses native vegetation.
2. African catfish: Correct — A non-native species banned in India due to its **threat to indigenous fish populations**.
3. Snow trout: Incorrect — A **native fish species of Himalayan rivers**, not invasive.
4. Papaya mealybug: Correct — An invasive agricultural pest affecting papaya, cassava, and other crops.

Species	Impact
Lantana camara	Invades forest ecosystems
Parthenium hysterophorus (Congress grass)	Allergic weed affecting agriculture
Water hyacinth (*Eichhornia crassipes*)	Chokes water bodies
Prosopis juliflora	Alters dryland ecosystems

14. Consider the following pairs:

Phenomenon	Explanation
1. Ice–albedo feedback in polar regions	Loss of reflective ice surfaces increases solar absorption and accelerates warming
2. Arctic amplification	Polar regions warming faster than the global average due to climate feedback mechanisms
3. Urban heat island effect	Dark urban surfaces such as asphalt absorb more solar radiation compared to natural landscapes
4. Glacier retreat and cryosphere changes	Reduction of ice and snow cover exposes darker land or water surfaces

Which of the pairs given above are correctly matched?
(a) 1 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer: (d) 1, 2, 3 and 4**

📄 **Brief Answer Key**
Pair 1: Correct — Melting ice lowers surface reflectivity, increasing heat absorption (**ice–albedo feedback**).
Pair 2: Correct — **Arctic amplification** occurs because feedback mechanisms (including albedo loss) accelerate warming in polar regions.
Pair 3: Correct — **Urban heat island effect** arises when dark surfaces like asphalt absorb more heat than vegetation.
Pair 4: Correct — **Glacier retreat** exposes darker surfaces, reducing albedo and enhancing warming.

15. **Obligate mutualism is an ecological interaction in which two species are interdependent for survival and reproduction, such that neither species can complete its life cycle without the other. In this context, consider the following species pairs:**
1. **Fig tree – Fig wasp**
2. **Lichen (fungus – algae/cyanobacteria)**
3. **Coral – Zooxanthellae algae**
4. **Honeybee – Sunflower**

Which of the above represent examples of **obligate mutualism**?
Options:
(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(b) 1, 2 and 3 only

📄 **Brief Answer Key**
1. Fig tree – Fig wasp: Correct — The fig wasp pollinates the fig flower while reproducing inside it; both species are **mutually dependent**.
2. Lichen (fungus–algae): Correct — A **symbiotic association** where algae provide photosynthetic products and fungi offer protection and structure.
3. Coral – Zooxanthellae algae: Correct — Coral polyps rely on symbiotic algae for **photosynthetic nutrients**, essential for reef-building.
4. Honeybee – Sunflower: Incorrect — This is **facultative mutualism** (pollination), as both species can survive without this specific partnership.

16. **With reference to sector-wise contributions to global greenhouse gas (GHG) emissions, arrange the following**

sectors in the decreasing order of their share in total emissions:

1. Transportation
2. Industry
3. Agriculture, Forestry and Other Land Use (AFOLU)
4. Electricity and Heat Production

Select the correct answer using the codes given below:

(a) 1 – 2 – 3 – 4
(b) 3 – 2 – 1 – 4
(c) 2 – 4 – 1 – 3
(d) 4 – 3 – 2 – 1

✅ **Correct Answer: (d) 4 – 3 – 2 – 1**

📜 **Brief Answer Key**

4. Electricity & Heat Production: Largest contributor globally due to coal and fossil fuel–based power generation.

3. Agriculture, Forestry and Other Land Use (AFOLU): Major emissions from methane (livestock, rice cultivation) and land-use change.

2. Industry: Emissions from cement, steel, chemicals, and industrial energy use.

1. Transportation: Emissions mainly from road, aviation, and shipping fuels.

 According to the **Intergovernmental Panel on Climate Change** sectoral estimates:

- **Electricity & heat:** ~34–35%
- **AFOLU:** ~22–24%
- **Industry:** ~20–21%
- **Transport:** ~14–16%

17. **Ectoparasitism** is a type of parasitism in which the parasite **lives on the external surface of the host**, feeding on its blood or bodily fluids. These parasites often cause irritation, disease transmission, and weakening of the host.

Which of the following species represent **examples of Ectoparasitism**?

1. **Head Louse (Pediculus humanus capitis) and Humans**
2. **Ticks and Mammals**
3. **Hookworm (Ancylostoma) and Humans**
4. **Bedbugs and Humans**

Select the correct answer using the codes below:

A) 1 and 2 only
B) 2, 3, and 4 only
C) 1, 2, and 4 only
D) 1, 2, 3, and 4

Correct Answer: C) 1, 2, and 4 only

Explanation:

✓ **Head Louse (Ectoparasitism)** – Lice attach to **human hair and scalp**, feeding on blood externally.

✓ **Ticks (Ectoparasitism)** – Ticks are **external parasites on mammals**, sucking blood and sometimes transmitting diseases like Lyme disease.

Hookworm (Not Ectoparasitism – It is an Endoparasite) – Hookworms **live inside the intestines of their host**, making them **endoparasites**, not ectoparasites.

✓ **Bedbugs (Ectoparasitism)** – Bedbugs bite humans and **feed externally on blood**, making them classic **ectoparasites**.

18. **Predation** is a biological interaction where **one species (the predator) hunts, kills, and consumes another species (the prey)**. It plays a crucial role in **maintaining ecosystem balance** by controlling prey populations.

Which of the following species represent **examples of Predation**?

1. **Tiger and Deer**
2. **Venus Flytrap and Insects**
3. **Caterpillar and Leaves**
4. **Mosquito and Humans**

Select the correct answer using the codes below:

A) 1 and 2 only
B) 1, 2, and 3 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4

Correct Answer: A) 1 and 2 only

Explanation:

✓ **Tiger and Deer (Predation)** – The tiger **hunts, kills, and consumes** the deer, making this a **classic example of predation**.

✓ **Venus Flytrap and Insects (Predation)** – The Venus flytrap, a **carnivorous plant**, captures and digests insects, making it an **unusual example of plant-based predation**.

Caterpillar and Leaves (Not Predation – It is Herbivory) – While caterpillars consume plant leaves, **herbivory is different from predation** because it does not necessarily kill the plant.

Mosquito and Humans (Not Predation – It is Parasitism) – Mosquitoes **extract blood but do not kill** their host, making this an example of **parasitism, not predation**.

19. **Antibiosis** is a type of **amensalism** where one organism **produces chemicals that inhibit or kill another organism**, while the producer remains unaffected or even benefits. This interaction is commonly seen in microbes, plants, and fungi.
Which of the following species represent **examples of Antibiosis**?

1. Penicillium Fungus and Bacteria
2. **Streptomyces Bacteria and Other Microorganisms**
3. **Black Walnut Tree and Nearby Plants**
4. **Cattle Grazing and Grass**

Select the correct answer using the codes below:

A) 1 and 2 only
B) 1, 2, and 3 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4

Correct Answer: B) 1, 2, and 3 only
Explanation:

✓ **Penicillium Fungus and Bacteria (Antibiosis)** – The **Penicillium fungus produces penicillin**, which **kills or inhibits bacteria**, while the fungus remains unaffected or even benefits.

✓ **Streptomyces Bacteria and Other Microorganisms (Antibiosis)** – **Streptomyces produce antibiotics**, which suppress the growth of competing bacteria, helping them dominate microbial communities.

✓ **Black Walnut Tree and Nearby Plants (Antibiosis)** – The tree **releases juglone**, a chemical that **inhibits the growth of nearby plants**, allowing the walnut tree to compete more effectively for nutrients and sunlight.

Cattle Grazing and Grass (Not Antibiosis – It is Herbivory) – Cattle **consume grass**, but this is a case of **herbivory, not antibiosis**, because there is no chemical inhibition involved.

20. **Agriculture is both vulnerable to climate change and a significant contributor to greenhouse gas emissions. In this context, consider the following factors:**

1. Land-use changes such as deforestation and conversion of forests into agricultural land
2. Intensive farming practices involving heavy fertilizer use and mechanization
3. Promotion of vegetarian dietary patterns
4. Livestock rearing and dairy production

Which of the above factors can contribute to **climate change**?

Options:

(a) 1 only
(b) 1, 2 and 4 only
(c) 2 and 3 only
(d) 1, 2, 3 and 4

✅ **Correct Answer: (b) 1, 2 and 4 only**

🗞️ **Brief Answer Key**

1. Land-use changes: Correct — Deforestation and land conversion release large amounts of **stored carbon** into the atmosphere.
2. Intensive farming: Correct — Use of **nitrogen fertilizers** releases nitrous oxide (N_2O), a potent greenhouse gas.
3. Promotion of vegetarianism: Incorrect — Plant-based diets generally **reduce emissions** compared to meat-based diets.
4. Livestock and dairy: Correct — Ruminants such as cattle emit **methane (CH_4)** through enteric fermentation and manure management.

21. **With reference to Bisphenol A (BPA), a chemical widely used in plastic manufacturing, consider the following statements:**

1. It is used in the production of **polycarbonate plastics and epoxy resins**.
2. It is a **colorless solid that is completely soluble in water**.
3. Human exposure to BPA can occur through **air, water, and food (dietary intake)**.

Which of the statements given above is/are correct?

Options:

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

✅ **Correct Answer: (b) 1 and 3 only**

📄 **Brief Answer Key**

Statement 1: Correct — BPA is widely used in **polycarbonate plastics and epoxy resins**, such as those lining food and beverage cans.
Statement 2: Incorrect — BPA is **only slightly soluble in water**, not completely soluble.
Statement 3: Correct — Exposure occurs mainly through **food packaging, contaminated water, dust, and air**.

22. **Amensalism is a type of ecological interaction in which one species is inhibited or harmed, while the other species remains largely unaffected. Such interactions often arise due to chemical inhibition (allelopathy or antibiotics) or unintentional suppression of other organisms. In this context, consider the following species pairs:**

1. **Black walnut tree (*Juglans nigra*) – Nearby plants**
2. **Penicillium fungus – Bacteria**
3. **Cattle grazing – Insects in grasslands**
4. **Lion – Hyena**

Which of the above pairs represent examples of **amensalism**?

Options:

(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**

(a) 1 and 2 only

📄 **Brief Answer Key**

1. Black walnut tree – Nearby plants: Correct — The tree releases **juglone**, a chemical that inhibits the growth of surrounding plants (allelopathy).
2. Penicillium fungus – Bacteria: Correct — The fungus produces **penicillin**, which suppresses bacterial growth.
3. Cattle grazing – Insects: Incorrect — Grazing affects insects but typically through **predation or habitat disturbance**, not classic amensalism.
4. Lion – Hyena: Incorrect — This represents **competition/predation interactions**, not amensalism.

Interaction	Key Feature	Example
Amensalism	One harmed, other unaffected	Black walnut–plants
Allelopathy	Chemical inhibition among plants	Juglone from walnut
Antibiosis	Microbial chemical inhibition	*Penicillium* vs bacteria
Competition	Both species negatively affected	Lion vs hyena

23. **Epiphytes** are plants that **grow on other plants for physical support** but **do not extract nutrients or harm the host plant**. They rely on air, rain, and organic debris for sustenance, often found in tropical and temperate forests.
Which of the following species represent **examples of Epiphytes**?

1. Orchids growing on tree branches
2. Mistletoe on Mango Trees
3. Spanish Moss (Tillandsia usneoides) on Oak Trees
4. Banyan Tree (Ficus benghalensis) Growing on Other Trees

Select the correct answer using the codes below:

A) 1 and 3 only
B) 1, 3, and 4 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4

Correct Answer: A) 1 and 3 only

Explanation:

Orchids (Epiphyte) – **Grow on tree branches**, using them **only for support**, while absorbing water and nutrients from the air.

Spanish Moss (Epiphyte) – **Hangs from tree branches** but does not extract nutrients from the host, making it a **true epiphyte**.

Mistletoe (Not an Epiphyte – It is a Parasitic Plant) – Mistletoe **attaches to host trees and extracts nutrients** through haustoria, making it a **parasitic plant, not an epiphyte**.

Banyan Tree (Not an Epiphyte – It is a Strangler Fig) – Although the **Banyan starts as an epiphyte**, it **later sends aerial roots into the ground** and **eventually kills the host tree**, making it a **strangler plant, not a true epiphyte**.

24. The **Tundra Ecosystem** is characterized by **extreme cold temperatures, permafrost, and low biodiversity**. The **flora and fauna** in this biome have adapted to survive harsh conditions, short growing seasons, and limited precipitation.
Which of the following statements about the **Tundra Ecosystem** are correct?

1. **Mosses, lichens, and dwarf shrubs dominate the tundra flora** due to shallow soil and permafrost.
2. **Caribou, Arctic foxes, and Snowy owls are common fauna** found in the tundra.
3. **The tundra experiences high annual rainfall, leading to dense forests and rich vegetation.**
4. **Permafrost prevents deep-rooted plants from growing, restricting vegetation to low-lying species.**

Select the correct answer using the codes below:
A) 1 and 2 only
B) 1, 2, and 4 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4
Correct Answer: B) 1, 2, and 4 only
Explanation:

✓ **Statement 1 (Correct – Tundra Flora)** – **Mosses, lichens, and dwarf shrubs dominate the tundra** because the soil is **nutrient-poor**, and **permafrost prevents deep-rooted plant growth**.

✓ **Statement 2 (Correct – Tundra Fauna)** – **Caribou (reindeer), Arctic foxes, and Snowy owls** are well-adapted to the tundra's **cold climate and seasonal food availability**.

Statement 3 (Incorrect – Climate Misconception) – The tundra has **very low annual precipitation (less than 25 cm)**, often making it a **cold desert**, and it **does not support dense forests**.

✓ **Statement 4 (Correct – Permafrost Impact)** – **Permafrost (permanently frozen ground)** restricts plant growth, allowing **only shallow-rooted vegetation** such as mosses, grasses, and low shrubs.

25. **Metabiosis is an ecological interaction in which one organism modifies the environment in a way that benefits another organism later, without direct interaction between them. The second organism typically utilizes structures, resources, or habitats created by the first. In this context, consider the following species pairs:**

1. **Beavers – Aquatic ecosystems**
2. **Hermit crabs – Empty snail shells**
3. **Dead trees – Woodpeckers**
4. **Barnacles – Whales**

Which of the above represent examples of **metabiosis**?
Options:
(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(b) 1, 2 and 3 only

📄 **Brief Answer Key**
1. Beavers – Aquatic ecosystems: Correct — Beaver dams modify river systems, creating wetlands that support many aquatic organisms.
2. Hermit crabs – Snail shells: Correct — Hermit crabs use **empty shells left behind by dead snails**, benefiting from a resource created by another organism.
3. Dead trees – Woodpeckers: Correct — Woodpeckers nest in cavities of **dead or decaying trees**, benefiting from habitat structures created after tree death.

4. Barnacles – Whales: Incorrect — This represents **commensalism**, where barnacles attach to whales and benefit from transport and feeding opportunities.

Interaction Type	Key Feature	Example
Metabiosis	One organism indirectly benefits from environmental modification by another	Hermit crab–snail shell
Commensalism	One benefits, other unaffected	Barnacles–whales
Mutualism	Both species benefit	Bee–flower
Amensalism	One harmed, other unaffected	Penicillium –bacteria

26. The **Taiga Ecosystem** (also known as the **Boreal Forest**) is a **cold, coniferous forest biome** found in the **Northern Hemisphere**, characterized by **long, harsh winters, short summers, and moderate precipitation**. Which of the following statements about the **Taiga Ecosystem** are correct?

1. **Taiga forests primarily consist of coniferous trees like spruce, fir, and pine, adapted to cold temperatures.**
2. **Winters in the Taiga are mild with high rainfall, creating favorable conditions for diverse plant life.**
3. **Common fauna in the Taiga include large mammals such as moose, bears, and wolves, as well as migratory birds.**
4. **Taiga forests experience frequent wildfires, which play a role in maintaining ecological balance.**

Select the correct answer using the codes below:

A) 1 and 3 only
B) 1, 3, and 4 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4

Correct Answer: B) 1, 3, and 4 only

Explanation:

✓ **Statement 1 (Correct – Coniferous Vegetation)** – The **Taiga is dominated by coniferous trees** such as **spruce, fir, and pine**, which are **adapted to withstand extreme cold, low sunlight, and nutrientpoor soils**.

Statement 2 (Incorrect – Harsh Winters and Low Rainfall) – Winters in the **Taiga are extremely cold and long**, with **low precipitation**, mostly in the form of snow. This **limits plant diversity**, making it a less hospitable environment.

✓ **Statement 3 (Correct – Fauna of the Taiga)** – The **Taiga supports large mammals** like **moose, brown bears, lynxes, and wolves**, which have **thick fur for insulation**. **Migratory birds** visit during the short summer season.

Statement 4 (Correct – Role of Wildfires) – **Wildfires are common in Taiga forests**, as **dry conifer needles and resinous trees** make the ecosystem prone to fire. These fires **help in nutrient recycling and clearing old vegetation**, aiding regeneration.

27. **Point sources of water pollution are pollutants that originate from a single, identifiable discharge point such as a pipe, outlet, or channel. Non-point sources arise from diffuse or scattered activities over a wide area. In this context, consider the following:**

1. Factories
2. Sewage treatment plants
3. Oil tankers
4. Acid deposition from atmospheric pollution
5. Livestock feedlots

Which of the above are **not considered point sources** of water pollution?

Options:

(a) 1, 2 and 4 only
(b) 1, 2, 3 and 5 only
(c) 4 and 5 only
(d) 1, 2, 3, 4 and 5

✅ **Correct Answer**

(c) 4 and 5 only

📄 **Brief Answer Key**

1. Factories: Point source — Industrial effluents usually discharge through identifiable outlets or pipes.
2. Sewage treatment plants: Point source — Treated or untreated wastewater is released through specific discharge points.
3. Oil tankers: Point source — Oil spills occur from identifiable vessels or pipelines.
4. Acid deposition: Not a point source — It is a **diffuse atmospheric pollutant** deposited over large areas through rain or dry deposition.
5. Livestock feedlots: Not typically a point source — Runoff carrying nutrients and waste is generally **diffuse agricultural pollution**.

Type	Characteristics	Example
Point source	Single identifiable discharge	Factory pipe, sewage outlet
Non-point source	Diffuse and widespread	Agricultural runoff, acid rain

2. Eucalyptus – Understory vegetation: Correct — Eucalyptus leaves release chemicals that suppress growth of nearby vegetation.
3. Rice – Weeds: Correct — Certain rice varieties release **allelochemicals that inhibit weed growth**, a concept used in sustainable agriculture.
4. Cuscuta – Host plants: Incorrect — This is **parasitism**, where the plant derives nutrients directly from the host.

Allelopathic Plant	Chemical Released	Effect
Black walnut	Juglone	Suppresses nearby plants
Eucalyptus	Phenolic compounds	Reduces understory growth
Rice varieties	Various allelochemicals	Natural weed control

28. **Allelopathy refers to a biological interaction in which certain plants release chemical compounds (allelochemicals) into the surrounding environment that suppress the germination, growth, or survival of neighboring plants. In this context, consider the following species pairs:**

1. **Black walnut tree (*Juglans nigra*) – Nearby plants**
2. **Eucalyptus tree – Understory vegetation**
3. **Rice (*Oryza sativa*) – Competing weeds**
4. **Cuscuta (Dodder) – Host plants**

Which of the above represent examples of **allelopathy**?
Options:
(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(b) 1, 2 and 3 only

🪜 **Brief Answer Key**
1. Black walnut – Nearby plants: Correct — Releases **juglone**, an allelochemical that inhibits growth of surrounding plants.

29. The **Grassland Ecosystem** is characterized by **vast open landscapes with dominant grass vegetation, moderate rainfall, and periodic droughts**. It supports a unique range of **herbivores and carnivores** adapted to its conditions.
Which of the following statements about the **Grassland Ecosystem** are correct?

1. **Grasslands experience moderate rainfall (25-75 cm per year), preventing the growth of large trees.**
2. **Temperate grasslands (like the Prairies and Steppes) have hot summers and cold winters, whereas tropical grasslands (like the Savanna) remain warm throughout the year.**
3. **Grassland fauna includes large herbivores such as bison, zebras, and antelopes, along with predators like lions and wolves.**
4. **Grasslands are found only in temperate regions and do not exist in tropical climates.**

Select the correct answer using the codes below:
A) 1 and 2 only
B) 1, 2, and 3 only
C) 2, 3, and 4 only

D) 1, 2, 3, and 4
Correct Answer: B) 1, 2, and 3 only
Explanation:

✓ **Statement 1 (Correct – Rainfall and Vegetation)** – Grasslands receive **moderate rainfall (25-75 cm per year)**, which is **enough to support grasses but not dense forests**. Periodic droughts and grazing pressure prevent tree growth.

✓ **Statement 2 (Correct – Climate Difference)** – **Temperate grasslands (like the Prairies, Pampas, and Steppes)** have **hot summers and cold winters**, whereas **tropical grasslands (like the Savanna)** remain **warm throughout the year**, with distinct wet and dry seasons.

✓ **Statement 3 (Correct – Fauna)** – Grasslands support **large grazing herbivores** like **bison (North America), zebras (Africa), and antelopes (Asia and Africa)**, along with **predators like lions, cheetahs, and wolves**.

Statement 4 (Incorrect – Geographic Range) – Grasslands exist in **both temperate and tropical regions**.

- **Temperate Grasslands**: Prairies (North America), Pampas (South America), Steppes (Eurasia).
- **Tropical Grasslands**: Savanna (Africa), Campos (South America), and Deccan Plateau grasslands (India).

30. Dissolved Oxygen (DO) is a crucial parameter for assessing water quality. A decline in DO levels in a freshwater lake is most likely to result in:
A) Increased fish population and aquatic biodiversity
B) Higher decomposition rates leading to algal blooms
C) Mass fish mortality and the collapse of aquatic life
D) Increased oxygen availability for bottomdwelling organisms
Correct Answer: C) Mass fish mortality and the collapse of aquatic life
Explanation:

✓ **Dissolved Oxygen (DO) is essential for aquatic life** – Fish and other aquatic organisms rely on **DO for respiration**. ✓ **Low DO levels (<4 mg/L) can lead to fish kills** – Oxygen depletion can cause **hypoxia or anoxic conditions**, leading to **mass mortality in fish and other aquatic species**.

✓ **Human impact on DO** – Factors like **excessive nutrient runoff, organic waste, and thermal pollution** can lower DO levels. ✓ **Eutrophication risk** – Algal blooms triggered by organic pollution can **further deplete oxygen**, worsening aquatic conditions.

31. **In ecological classification, organisms are often categorized based on their feeding habits. Which of the following pairs are correctly matched?**

1. **Necrophages** – Feed on dead and decaying animal flesh
2. **Xylophages** – Feed primarily on wood or woody plant material
3. **Coprophages** – Feed on animal feces
4. **Mycophagous organisms** – Feed on fungi

Select the correct answer using the codes given below:
(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(d) 1, 2, 3 and 4

📄 **Brief Answer Key**
1. Necrophages: Correct — Organisms such as vultures and carrion beetles feed on **dead animal carcasses**.
2. Xylophages: Correct — Organisms like termites and certain beetles consume **wood and lignocellulosic plant material**.
3. Coprophages: Correct — Species such as dung beetles feed on **animal feces**.
4. Mycophagous: Correct — Organisms that feed on **fungi**, e.g., certain insects and mollusks.

Feeding Type	Ecological Role	Example
Necrophages	Scavengers aiding decomposition	Vultures
Coprophages	Recycle nutrients from waste	Dung beetles

Xylophages	Break down woody biomass	Termites
Mycophagous	Control fungal populations	Fungus-feeding beetles

32. Tropical and Temperate Rainforests are two distinct types of forest ecosystems that differ in **climate, vegetation, and biodiversity**.
Which of the following statements correctly differentiate between **Tropical Rainforests** and **Temperate Rainforests**?

1. **Tropical Rainforests are found near the equator**, while **Temperate Rainforests occur in mid-latitude coastal regions**.
2. **Tropical Rainforests have greater biodiversity**, including species like jaguars and orangutans, whereas **Temperate Rainforests have fewer species but include animals like black bears and elk**.
3. **Tropical Rainforests experience a dry season**, while **Temperate Rainforests receive rainfall throughout the year**.
4. **Both types of rainforests are dominated by broadleaf trees**, with coniferous trees being rare in both ecosystems.

Select the correct answer using the codes below:
A) 1 and 2 only
B) 1, 2, and 3 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4
Correct Answer: B) 1, 2, and 3 only
Explanation:
✓ **Statement 1 (Correct – Geographic Location)** – **Tropical Rainforests** are found **near the equator** (e.g., Amazon, Congo, Southeast Asia), while **Temperate Rainforests** occur **in mid-latitude coastal regions** (e.g., Pacific Northwest of the USA, Chile, and New Zealand).
✓ **Statement 2 (Correct – Biodiversity Difference)** – **Tropical Rainforests** have **exceptionally high biodiversity**, including **jaguars, toucans, and orangutans**.
Temperate Rainforests have **lower species diversity**, including **black bears, elk, and spotted owls**.
✓ **Statement 3 (Correct – Rainfall Pattern)** – **Tropical Rainforests** receive **high rainfall but may have a short dry season**, while **Temperate Rainforests** receive **consistent rainfall year-round**, often exceeding 200 cm annually.
Statement 4 (Incorrect – Tree Type Difference) –

- **Tropical Rainforests** are **dominated by broadleaf evergreen trees** (e.g., Mahogany, Kapok).
- **Temperate Rainforests** are **dominated by coniferous trees** (e.g., Douglas fir, Redwoods). Broadleaf trees are present but not dominant.

33. Ecological niche refers to the functional role and position of a species within its ecosystem. Which of the following is the best example illustrating the concept of an ecological niche?
(a) A Bengal tiger preying on spotted deer in an Indian forest and marking its territory with scent.
(b) A peacock displaying its vibrant feathers to attract a mate.
(c) A polar bear living in the Arctic and having thick fur to insulate against cold temperatures.
(d) A banyan tree growing in tropical climates and producing aerial roots to support its branches.
Correct Answer:
(a) A Bengal tiger preying on spotted deer in an Indian forest and marking its territory with scent.

34. A food chain represents the transfer of energy through different trophic levels in an ecosystem. Which of the following best illustrates a **terrestrial food chain**?
(a) Detritus → Earthworm → Frog → Snake → Hawk
(b) Mushroom → Termite → Lizard → Owl
(c) Neem Tree → Aphid → Butterfly → Crow
(d) Algae → Snail → Crab → Shark
Explanation:

A **food chain** shows the **flow of energy from producers to various levels of consumers** in an ecosystem. In a **terrestrial food chain**, organisms are land-based rather than aquatic.

- **Option (a) is correct** : This represents a **detritus-based terrestrial food chain**:
  - **Snake (Tertiary Consumer)** preys on the frog.
  - **Hawk (Top Predator)** hunts the snake.
  - This highlights the importance of detritivores in nutrient recycling, making it a more challenging but accurate choice.
- **Option (b) is incorrect** : **Mushrooms (fungi)** are **decomposers, not producers**; termites primarily consume wood, and this does not represent a classic food chain.
- **Option (c) is incorrect** : **Butterflies do not consume aphids**, and crows do not primarily feed on butterflies, breaking the logical flow of the food chain.
- **Option (d) is incorrect** : This represents an **aquatic food chain**, not a terrestrial one, making it an incorrect choice based on the question's emphasis.

Correct Answer:
(a) Detritus → Earthworm → Frog → Snake → Hawk

35. An **inverted pyramid of biomass** occurs when the total biomass at higher trophic levels is greater than at lower levels. Which of the following is the best example of an **inverted pyramid of biomass**?
(a) Phytoplankton → Zooplankton → Small Fish → Large Fish
(b) Grass → Grasshoppers → Frogs → Snakes
(c) Tree → Caterpillars → Birds → Hawk
(d) Detritus → Earthworms → Frogs → Snakes

Correct Answer:
(a) Phytoplankton → Zooplankton → Small Fish → Large Fish
Explanation:

A **biomass pyramid** represents the total mass of living organisms at each trophic level. An **inverted pyramid of biomass** occurs when the **biomass of consumers is greater than the biomass of producers**. This typically happens in **aquatic ecosystems**, where producers (phytoplankton) have **low biomass but high productivity**, supporting a larger biomass of consumers.

- **Option (a) is correct** : This represents an **inverted pyramid of biomass** in an **aquatic ecosystem**:
  - **Phytoplankton (Producers)** have very low biomass but reproduce rapidly.
  - **Zooplankton (Primary Consumers)** have a higher biomass than phytoplankton.
  - **Small Fish (Secondary Consumers)** have even more biomass.
  - **Large Fish (Tertiary Consumers)** have the highest biomass.
  - Since **phytoplankton are small and consumed quickly**, the **biomass at higher levels is greater**, making the pyramid **inverted**.
- **Option (b) is incorrect** : This is a **terrestrial food chain**, which typically follows an **upright pyramid of biomass**, where biomass decreases at higher trophic levels.
- **Option (c) is incorrect** : Though a **forest ecosystem may show an inverted pyramid of numbers**, it does **not** show an inverted biomass pyramid because the **tree has the largest biomass**.
- **Option (d) is incorrect** : Detritusbased chains follow complex patterns of biomass distribution but do not typically form an inverted biomass pyramid.

36. A **pyramid of energy** represents the flow of energy at different trophic levels in an ecosystem. Which of the following statements is **correct** regarding the pyramid of energy?
(a) It is always upright because energy decreases at each successive trophic level.

(b) It can be inverted in some ecosystems, where consumers store more energy than producers.
(c) It is based on the total biomass of organisms rather than the actual energy transfer.
(d) Energy transfer between trophic levels is **100% efficient**, with no loss as heat.
Correct Answer:
(a) It is always upright because energy decreases at each successive trophic level.
A **pyramid of energy** shows the **rate of energy flow per unit area per unit time** at each trophic level. Since **energy is lost as heat** at every step due to respiration and metabolic activities, the pyramid is **always upright**.

- **Option (a) is correct** : The **pyramid of energy is always upright** because:
  - **Producers (Plants, Phytoplankton)** capture solar energy and convert it into chemical energy.
  - Primary Consumers **(Herbivores)** receive only **about 10%** of the producer's energy, while the rest is lost as heat.
  - **Secondary and Tertiary Consumers (Carnivores, Top Predators)** receive even less energy due to successive energy losses at each level.
- **Option (b) is incorrect** : Unlike the **pyramids of biomass and numbers**, the **pyramid of energy can never be inverted**, because energy **always flows from lower to higher levels with a loss at each step**.
- **Option (c) is incorrect** : The pyramid of energy is based on **actual energy flow (calories or joules per unit area per year)**, not biomass.

Option (d) is incorrect : According to **Lindeman's 10% Law**, **only about 10% of energy** is transferred to the next trophic level, with the rest **lost as heat** due to respiration and other metabolic processes.

37. **Different greenhouse gases remain in the atmosphere for varying durations, influencing their long-term impact on climate change. Arrange the following greenhouse gases in the ascending order of their average atmospheric lifetime:**

1. Methane (CH_4)
2. Carbon dioxide (CO_2)
3. Nitrous oxide (N_2O)
4. Fluorinated gases (e.g., HFCs, PFCs)

Select the correct answer using the codes below:
(a) Fluorocarbons – Nitrous oxide – Carbon dioxide – Methane
(b) Carbon dioxide – Methane – Fluorocarbons – Nitrous oxide
(c) Nitrous oxide – Fluorocarbons – Methane – Carbon dioxide
(d) Methane – Carbon dioxide – Nitrous oxide – Fluorocarbons

✅ **Correct Answer**
(d) Methane – Carbon dioxide – Nitrous oxide – Fluorocarbons

📜 **Brief Answer Key**
Methane: Shortest lifetime (~12 years) though highly potent as a greenhouse gas.
Carbon dioxide: Remains in the atmosphere for **hundreds of years**, depending on carbon cycle processes.
Nitrous oxide: Long atmospheric lifetime (~114 years).
Fluorinated gases: Extremely long-lived (often **hundreds to thousands of years**) and very high global warming potential.

38. **What do Coprophages primarily consume?**

(A) Dead and decaying organisms
(B) Feces and animal dung
(C) Fungi and mushrooms
(D) Rotten wood and bark
Correct Answer: (B) **Feces and animal dung**

39. Which of the following factors **directly influence aquatic productivity** in lakes and oceans?

1. **Sunlight availability**
2. **Nutrient concentration**
3. **Dissolved oxygen levels**
4. **Salinity variations Select the correct answer using the codes below: A)** 1 and 2 only

B) 1, 2, and 3 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4

Correct Answer: D) 1, 2, 3, and 4

Explanation:

✓ **Sunlight availability (Affects Primary Productivity)** – Sunlight is essential for **photosynthesis** by phytoplankton and aquatic plants, driving primary production.

✓ **Nutrient concentration (Key Limiting Factor)** – **Nitrogen and phosphorus** are major nutrients influencing the growth of aquatic organisms. Excess nutrients can lead to **eutrophication**.

✓ **Dissolved oxygen levels (Affects Respiration and Growth)** – Oxygen availability determines **the survival of fish, zooplankton, and other aerobic organisms** in aquatic ecosystems.

✓ **Salinity variations (Impacts Species Composition and Productivity)** – Changes in salinity affect **osmotic balance, species distribution, and overall ecosystem stability**, particularly in estuarine and marine environments.

40. Which of the following best describes the concept of an **ecological niche** in an ecosystem?
(a) A honeybee collecting nectar from flowers and pollinating plants in the process. **(b)** A cactus storing water in its stem to survive in arid conditions. **(c)** A penguin having a thick layer of fat to survive in cold environments. **(d)** A vulture having strong eyesight to locate carcasses from a long distance.
Correct Answer:
(a) A honeybee collecting nectar from flowers and pollinating plants in the process.
Explanation:
An **ecological niche** is not just about where an organism lives (habitat) but **how it interacts with its environment**, including food habits, behavior, and ecological role.

- **Option (a)** correctly represents an ecological niche because the honeybee is playing an active role in pollination while also collecting nectar for survival, influencing plant reproduction.
- **Option (b)** describes an adaptation (water storage) but does not define the organism's role in the ecosystem.
- **Option (c)** focuses on a physiological adaptation rather than an ecological function.
- **Option (d)** highlights a biological feature but does not define the vulture's niche, which includes scavenging and nutrient recycling.

41. **Biomagnification** refers to the increase in the concentration of toxic substances as they move up the food chain. Which of the following is the best example illustrating the concept of **biomagnification**?
(a) A honeybee collecting nectar from flowers and pollinating plants in the process.
(b) DDT pesticide concentration increasing in the tissues of predatory birds like eagles due to feeding on contaminated fish.
(c) A deer migrating from one forest to another in search of food.
(d) A vulture feeding on multiple carcasses in its habitat.
Correct Answer:
(b) DDT pesticide concentration increasing in the tissues of predatory birds like eagles due to feeding on contaminated fish.
Explanation:
Biomagnification occurs when toxic substances (such as **pesticides, heavy metals, or industrial pollutants**) accumulate at progressively higher concentrations in organisms at higher trophic levels in a food chain.

- **Option (b) is correct** :
  - DDT (a pesticide) enters water bodies and is absorbed by **small aquatic organisms (producers & primary consumers)**.
  - **Fish (secondary consumers)** consume these organisms, leading to **higher concentrations of DDT** in their bodies.
  - **Eagles (top predators)** feed on contaminated fish,

accumulating even greater DDT levels in their tissues.
    - Since **toxins increase in concentration at each trophic level**, this is a clear case of **biomagnification**.
- **Option (a) is incorrect** : Pollination is an ecological interaction, not an example of toxin accumulation in a food chain.
- **Option (c) is incorrect** : Migration is a movement behavior and does not involve the increasing concentration of toxic substances.
- **Option (d) is incorrect** : While vultures consume multiple carcasses, this does not specifically illustrate **progressive toxin concentration along trophic levels**.

42. Ecological succession refers to the gradual and natural replacement of one biological community by another over time. Which of the following is the best example of **ecological succession**?

(a) A predator species adapting to hunt different prey due to food scarcity.

(b) A forest fire temporarily reducing the number of trees in a given area, after which the same tree species grow back.

(c) A population of deer migrating from one forest to another due to seasonal changes.

(d) A volcanic island developing plant life over centuries, starting with lichens and mosses, followed by grasses and trees.

Correct Answer:

(d) A volcanic island developing plant life over centuries, starting with lichens and mosses, followed by grasses and trees.

Explanation:

Ecological succession is the **gradual transformation** of ecosystems over time due to natural processes, where **pioneer species** establish themselves first, followed by the arrival of more complex communities.

- **Option (d) is correct** :
    - This represents **primary succession**, occurring on newly formed or barren landscapes like a **volcanic island** with no pre-existing soil.
    - **Pioneer species** like **lichens and mosses** initiate soil formation.
    - Over time, **grasses, shrubs, and trees** establish themselves, leading to a stable ecosystem.
    - This is a textbook example of **ecological succession**.
- **Option (a) is incorrect** : Adaptation of predators to hunt different prey is **an evolutionary process**, not a case of ecosystem succession.
- **Option (b) is incorrect** : If the **same species** of trees grow back after a fire, it is **natural regeneration**, not succession. However, if different species gradually replace the original ones, it would be **secondary succession**.
- **Option (c) is incorrect** : Migration is **a behavioral response** to environmental conditions, not a gradual replacement of communities over time.

43. Which of the following best describes **ecological succession**?

(a) The gradual replacement of one biological community by another over time.

(b) The seasonal migration of birds from one region to another.

(c) The adaptation of a species to survive in a new environment.

(d) The sudden disappearance of a species due to natural disasters.

Correct Answer:

(a) The gradual replacement of one biological community by another over time.

This definition captures the essence of **ecological succession**, where ecosystems **gradually evolve**, replacing one community with another over time due to natural processes.

44. Which of the following correctly describes an important process in the **nitrogen cycle**?

(a) Nitrogen-fixing bacteria convert atmospheric nitrogen (N_2) into ammonia (NH_3), making it available to plants.

(b) Plants absorb atmospheric nitrogen (N_2) directly for their growth and development.
(c) Decomposers convert ammonia into atmospheric nitrogen (N_2) in the final stage of the nitrogen cycle.
(d) Oxygen plays a major role in converting nitrogen compounds into usable forms for plants.
Correct Answer:
(a) Nitrogen-fixing bacteria convert atmospheric nitrogen (N_2) into ammonia (NH_3), making it available to plants.
Explanation:
The **nitrogen cycle** is essential for maintaining nitrogen availability in ecosystems, as most organisms cannot use atmospheric nitrogen (N_2) directly.

- **Option (a) is correct** :
  - **Nitrogen-fixing bacteria** (e.g., *Rhizobium, Azotobacter*) **convert atmospheric nitrogen (N_2) into ammonia (NH_3)**, which is further processed into **nitrates and nitrites** for plant uptake.
  - This process is **crucial for making nitrogen available to living organisms**.
- **Option (b) is incorrect** : **Plants cannot absorb nitrogen directly from the atmosphere**; they rely on nitrogen-fixing bacteria to convert it into usable forms.
- **Option (c) is incorrect** : **Decomposers break down organic matter**, releasing ammonia, but **denitrifying bacteria** (not decomposers) convert nitrogen compounds back into **atmospheric nitrogen (N_2)**.
- **Option (d) is incorrect** : Oxygen is not a primary factor in nitrogen conversion; **bacteria and soil microorganisms** drive the nitrogen cycle.

45. Which of the following correctly represents the different **phases of the nitrogen cycle** in the correct sequence?
(a) Nitrogen Fixation → Nitrification → Assimilation → Ammonification → Denitrification
(b) Nitrification → Nitrogen Fixation → Denitrification → Assimilation → Ammonification
(c) Denitrification → Ammonification → Assimilation → Nitrogen Fixation → Nitrification
(d) Ammonification → Nitrogen Fixation → Denitrification → Nitrification → Assimilation **Correct Answer:**
(a) Nitrogen Fixation → Nitrification → Assimilation → Ammonification → Denitrification
Explanation:
The **nitrogen cycle** involves several key processes that convert nitrogen into different forms, making it available for organisms and returning it to the atmosphere.

- **Option (a) is correct** :
  1. **Nitrogen Fixation** – Atmospheric nitrogen (**N_2**) is converted into ammonia (**NH_3**) by nitrogen-fixing bacteria (e.g., *Rhizobium*).
  2. **Nitrification** – Ammonia is converted into nitrites (**NO_2^-**) and then into nitrates (**NO_3^-**) by nitrifying bacteria (*Nitrosomonas* and *Nitrobacter*).
  3. **Assimilation** – Plants absorb nitrates and incorporate them into organic molecules like proteins.
  4. **Ammonification** – Decomposers break down dead organisms and release ammonia back into the soil.
  5. **Denitrification** – Denitrifying bacteria (*Pseudomonas* and *Clostridium*) convert nitrates back into nitrogen gas (**N_2**) and release it into the atmosphere.
- **Option (b) is incorrect** : Nitrogen fixation must come **before nitrification**, and **denitrification** occurs at the end.
- **Option (c) is incorrect** : Denitrification happens last, not first. Nitrogen fixation must precede nitrification.
- **Option (d) is incorrect** : Ammonification does not occur before nitrogen fixation in the cycle.

46. **The phosphorus cycle is an important biogeochemical cycle that regulates the availability of phosphorus in ecosystems. In this context, which of the following statements correctly describes a key characteristic of the phosphorus cycle?**
(a) The phosphorus cycle is faster than the nitrogen cycle because phosphorus readily circulates through the atmosphere.
(b) Atmospheric phosphorus serves as the principal source of phosphorus for plants.
(c) Phosphorus mainly cycles through fossil fuel combustion and industrial emissions.
(d) Unlike carbon and nitrogen, phosphorus lacks a significant gaseous phase and primarily circulates through rocks, soil, water, and living organisms.

✅ **Correct Answer**
(d) Unlike carbon and nitrogen, phosphorus lacks a significant gaseous phase and mainly cycles through rocks, soil, water, and living organisms.

🧾 **Brief Answer Key**
Option (d): Correct — The phosphorus cycle is largely **sedimentary**, with phosphorus moving through **rock weathering, soil, water bodies, and biological uptake**.
Option (a): Incorrect — The phosphorus cycle is generally **slow** because it depends on geological processes such as rock weathering.
Option (b): Incorrect — There is **no major atmospheric reservoir** of phosphorus.
Option (c): Incorrect — Fossil fuel combustion is mainly associated with the **carbon and sulfur cycles**, not phosphorus.

47. **Eutrophication is a major environmental problem affecting freshwater and coastal ecosystems due to excessive nutrient enrichment. In this context, which of the following statements best describes the process of eutrophication?**
(a) The gradual accumulation of sediments in lakes that eventually transforms them into wetlands over long geological periods.
(b) Excessive input of nutrients such as **nitrogen and phosphorus** into water bodies, resulting in algal blooms and depletion of dissolved oxygen.
(c) The buildup of toxic heavy metals in aquatic organisms due to industrial pollution.
(d) Rapid decomposition of organic matter in water bodies that increases dissolved oxygen levels for aquatic organisms.

✅ **Correct Answer**
(b) Excessive input of nutrients such as nitrogen and phosphorus leading to algal blooms and oxygen depletion.

🧾 **Brief Answer Key**
Option (b): Correct — Nutrient enrichment stimulates **algal blooms**, whose decomposition consumes oxygen and causes **hypoxia**.
Option (a): Incorrect — This describes **natural lake succession or sedimentation**, not eutrophication.
Option (c): Incorrect — This refers to **bioaccumulation of heavy metals**.
Option (d): Incorrect — Decomposition usually **reduces dissolved oxygen**, not increases it.

48. **Consider the following statements:**
Statement 1:
Natural selection is the process by which organisms possessing **advantageous heritable traits** are more likely to survive and reproduce under environmental pressures, resulting in evolutionary change over generations.
Statement 2:
Artificial selection occurs **without human intervention** and leads to the survival of the fittest individuals through random environmental processes.
Which one of the following is correct in respect of the above statements?
(a) Both Statement 1 and Statement 2 are correct, and Statement 2 explains Statement 1.
(b) Both Statement 1 and Statement 2 are correct, but Statement 2 does not explain Statement 1.
(c) Statement 1 is correct, but Statement 2 is incorrect.
(d) Statement 1 is incorrect, but Statement 2 is correct.

✅ **Correct Answer: (c) Statement 1 is correct, but Statement 2 is incorrect.**

📝 **Brief Answer Key**

Statement 1: Correct — Natural selection, proposed by **Charles Darwin**, explains how **environmental pressures favour organisms with beneficial traits**, leading to evolution.
Statement 2: Incorrect — Artificial selection is **deliberately carried out by humans** to select desirable traits (e.g., crop breeding, dog breeds, dairy cattle).
Examples often used in exams:

- **Natural selection:** Industrial melanism in peppered moths.
- **Artificial selection:** Hybrid crops, high-yield varieties, selective breeding of livestock.

49. **Consider the following description of a greenhouse gas:**

- It is emitted from **natural sources such as wetlands** and from **anthropogenic activities including livestock rearing and leakage from natural gas systems**.
- It is a **potent greenhouse gas** with a high capacity to trap heat by absorbing both **incoming solar radiation and outgoing terrestrial radiation**.

Which of the following greenhouse gases is being described above?
(a) Chlorofluorocarbons (CFCs)
(b) Nitrogen oxides (NOx)
(c) Methane
(d) Carbon dioxide

✅ **Correct Answer: (c) Methane**

📝 **Brief Answer Key**

- **Methane (CH_4)** is produced from **wetlands, rice cultivation, ruminant livestock (enteric fermentation), landfills, and fossil fuel extraction**.
- It has a **Global Warming Potential (GWP) about 28–34 times higher than CO_2 over a 100-year period**.

Greenhouse Gas	Major Source	Relative Warming Impact
CO_2	Fossil fuels, deforestation	Baseline
Methane (CH_4)	Livestock, wetlands, gas leaks	~28–34× CO_2
Nitrous oxide (N_2O)	Fertilizers	~265–298× CO_2
CFCs	Refrigerants	Very high but regulated by Montreal Protocol

50. **Methane (CH_4) is a potent greenhouse gas emitted from both natural processes and human activities. In this context, consider the following groups of emission sources:**

(a) Rice cultivation, enteric fermentation in livestock, leakage from natural gas systems
(b) Cement production, coal combustion in thermal power plants, iron and steel manufacturing
(c) Nitrogen fertilizer application, soil microbial activity, biomass burning
(d) Refrigerant leakage from air conditioners, aerosol propellants, foam insulation industries

✅ **Correct Answer: (a)**

Option (a): Correct — Major methane sources include:

- **Rice paddies** (anaerobic decomposition in flooded fields)
- **Livestock enteric fermentation** (ruminant digestion)
- **Leakage from natural gas systems and oil extraction**

Option (b): Mainly sources of **carbon dioxide (CO_2)**.
Option (c): Primarily associated with **nitrous oxide (N_2O)** and other emissions.
Option (d): Mainly related to **chlorofluorocarbons (CFCs) or hydrofluorocarbons (HFCs)**.
Major **global methane emission sectors**:

Sector	Examples
Agriculture	Livestock, rice cultivation
Energy	Oil and gas extraction, pipeline leaks

Waste	Landfills, wastewater
Natural	Wetlands, termites

51. **Evolutionarily Distinct and Globally Endangered (EDGE) species are organisms that represent a unique evolutionary lineage with few close relatives and are also at a high risk of extinction. Protecting such species helps conserve large amounts of evolutionary history. In this context, consider the following species found in India:**

1. **Ganges River Dolphin (*Platanista gangetica*)** – A freshwater cetacean endemic to the Indian subcontinent.
2. **Indian Pangolin (*Manis crassicaudata*)** – A scaly mammal threatened by illegal wildlife trade.
3. **Indian Star Tortoise (*Geochelone elegans*)** – A reptile heavily trafficked in the international pet trade.
4. **Snow Leopard (*Panthera uncia*)** – A high-altitude predator adapted to cold Himalayan ecosystems.

Which of the above species are recognised as **EDGE species**?
(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 1, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer: (a) 1 and 2 only**

📄 **Brief Answer Key**

1. Ganges River Dolphin: Correct — Listed as an **EDGE species** because of its unique evolutionary lineage among freshwater dolphins and its endangered status.
2. Indian Pangolin: Correct — Pangolins represent a **distinct evolutionary branch (Order Pholidota)** and are among the **most trafficked mammals in the world**, making them EDGE species.
3. Indian Star Tortoise: Incorrect — Though threatened and heavily trafficked, it is **not listed under the EDGE programme**.
4. Snow Leopard: Incorrect — While **Vulnerable (IUCN)** and a key conservation species, it is **not categorised under the EDGE list**.

52. **Which of the following best describes "Evolutionarily Distinct and Globally Endangered (EDGE) species"?**
(a) Species that have a disproportionately large ecological impact relative to their population size
(b) Species that are evolutionarily unique with few close relatives and are also facing a high risk of extinction
(c) Species selected to represent a conservation campaign or habitat for public awareness
(d) Species whose protection automatically ensures the conservation of many other species in the ecosystem

---

✅ **Correct Answer: (b) Species that are evolutionarily unique with few close relatives and are also facing a high risk of extinction**

📄 **Brief Answer Key**

EDGE species are those that:

- Have **high evolutionary distinctiveness** (few close relatives in the evolutionary tree)
- Are **globally endangered or threatened**

They represent **large amounts of unique evolutionary history**, making their conservation especially important.

53. **With reference to different forms of parasitism in ecology, consider the following host–parasite pairs associated with *mesoparasitism*:**

1. **Anchor worm (*Lernaea*) – Freshwater fish**
2. **Candiru fish (*Vandellia cirrhosa*) – Gills of larger fish**
3. **Leeches – Mammals**
4. **Tongue-eating louse (*Cymothoa exigua*) – Marine fish**

Which of the pairs given above correctly represent examples of mesoparasitism?
Options:
A. 1 and 2 only
B. 1, 2 and 4 only
C. 2, 3 and 4 only
D. 1, 2, 3 and 4

Correct Answer

✅ **B. 1, 2 and 4 only**

Brief Explanation
What is Mesoparasitism?
Mesoparasitism is a **type of parasitic relationship where the parasite partly enters the host's body while a portion remains exposed to the external environment**, showing traits of both **ectoparasites** (external) and **endoparasites** (internal).
✓ **Copepods (Lernaea, "Anchor Worm") (Mesoparasitism)** – These **burrow into the skin of fish**, with their **rear end still exposed**, making them mesoparasites.
✓ **Candiru Fish (Mesoparasitism)** – This parasitic fish enters **the gills of larger fish** (and sometimes even mammals) to **feed on blood**, but it does not stay permanently inside, making it a mesoparasite.
Leeches (Not Mesoparasitism – It is Ectoparasitism) – Leeches **attach externally to the host** and **do not burrow or enter partially**, meaning they are **not mesoparasites**.
✓ **Tongue-Eating Louse (Mesoparasitism)** – This parasite **enters the fish's mouth, attaches to its tongue, and feeds on blood**, remaining partly inside and partly exposed.

54. **Kleptoparasitism refers to a biological interaction in which one organism steals food or resources captured or collected by another organism, thereby benefiting without investing energy in obtaining the resource itself. In this context, consider the following species interactions:**

1. **Frigate birds – Seabirds** (stealing fish caught by other seabirds)
2. **Cuckoo birds – Host birds** (laying eggs in the nests of other birds)
3. **Hyenas – Lions** (taking over prey hunted by lions)
4. **Spotted hyenas – Vultures** (competing for carcasses and sometimes stealing food)

Which of the above represent examples of **kleptoparasitism**?
Options:
(a) 1 and 3 only
(b) 1, 3 and 4 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(b) 1, 3 and 4 only

📜 **Brief Answer Key**
1. Frigate birds – Seabirds: Correct — Frigate birds frequently **harass other seabirds to force them to drop captured fish**, which they steal.
2. Cuckoo birds – Host birds: Incorrect — This is **brood parasitism**, not kleptoparasitism.
3. Hyenas – Lions: Correct — Hyenas may **steal prey hunted by lions**, an example of kleptoparasitic feeding behavior.
4. Spotted hyenas – Vultures: Correct — Spotted hyenas often **appropriate carcasses or food resources found by other scavengers**.

Interaction Type	Description	Example
Kleptoparasitism	Stealing food captured by another species	Frigate birds stealing fish
Brood parasitism	Laying eggs in another species' nest	Cuckoo bird
Parasitism	Parasite lives on/in host causing harm	Tapeworm
Scavenging	Feeding on dead organisms	Vultures

55. **Social parasitism is a biological interaction in which one species exploits the social organisation or cooperative behaviour of another species—such as nest-building, brood care, or food collection—for its own benefit. In this context, consider the following species interactions:**

1. **Cuckoo birds – Host birds**
2. **Slave-making ants (*Polyergus* spp.) – Other ant colonies**

3. **Fig wasp – Fig tree**
4. **Termite-killing beetle (*Austrospirachtha mimetes*) – Termites**

Which of the above represent examples of **social parasitism**?

Options

(a) 1 and 2 only
(b) 1, 2 and 4 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**

(b) 1, 2 and 4 only

📄 **Brief Answer Key**

1. Cuckoo birds – Host birds: Correct — Cuckoos exploit host birds' parental care by laying eggs in their nests; this is often treated as **brood/social parasitism**.
2. Slave-making ants – Other ant colonies: Correct — These ants raid other colonies and force captured workers to perform labour.
3. Fig wasp – Fig tree: Incorrect — This is a classic example of **mutualism**, where both species benefit through pollination.
4. Termite-killing beetle – Termites: Correct — The beetle infiltrates termite colonies and exploits their social system.

56. **Commensalism is an ecological interaction in which one species benefits while the other species is neither significantly harmed nor benefited. In this context, consider the following species interactions:**

1. **Remora fish – Sharks**
2. **Cattle egret – Grazing cattle**
3. **Barnacles – Whales**
4. **Oxpecker bird – Buffalo**

Which of the above represent examples of **commensalism**?

Options:

(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**

(b) 1, 2 and 3 only

📄 **Brief Answer Key**

1. Remora fish – Sharks: Correct — Remoras attach to sharks and gain **transport and leftover food**, while the shark is largely unaffected.
2. Cattle egret – Grazing cattle: Correct — Egrets feed on insects disturbed by grazing cattle without affecting them.
3. Barnacles – Whales: Correct — Barnacles attach to whales for **transport and feeding opportunities**, while whales experience little impact.
4. Oxpecker bird – Buffalo: Incorrect — This interaction is often considered **mutualism** because oxpeckers feed on parasites from the buffalo's skin.

Interaction Type	Key Feature	Example
Commensalism	One benefits, other unaffected	Remora–shark
Mutualism	Both benefit	Fig tree–fig wasp
Parasitism	Parasite benefits, host harmed	Tick–mammal
Predation	One organism kills another	Lion–deer

57.

23. Match the following international environmental conventions with their primary objectives:

List I (Convention)	List II (Primary Focus)
A. Rotterdam Convention	1. Control of transboundary movement of hazardous wastes
B. Basel Convention	2. Regulation of trade in certain hazardous chemicals and pesticides
C. Minamata Convention	3. Protection of human health and the environment from mercury emissions
D. Stockholm Convention	4. Elimination or restriction of persistent organic pollutants (POPs)

Select the correct answer using the codes below:

(a) A-2, B-1, C-3, D-4
(b) A-1, B-2, C-4, D-3
(c) A-2, B-3, C-1, D-4
(d) A-3, B-1, C-2, D-4

✅ **Correct Answer: (a) A-2, B-1, C-3, D-4**

📜 **Brief Answer Key**

- **Rotterdam Convention:** Prior Informed Consent (PIC) procedure for **hazardous chemicals and pesticides in international trade**.
- **Basel Convention:** Controls **transboundary movement and disposal of hazardous waste**.
- **Minamata Convention:** Addresses **mercury pollution and emissions**.
- **Stockholm Convention:** Targets **persistent organic pollutants (POPs)**.

58. **Which one of the following international environmental agreements aims to eliminate or restrict the production and use of Persistent Organic Pollutants (POPs) to protect human health and the environment?**
(a) Rotterdam Convention
(b) Basel Convention
(c) Minamata Convention
(d) Stockholm Convention

✅ **Correct Answer: (d) Stockholm Convention**

📜 **Brief Answer Key**

The **Stockholm Convention (2001)** seeks to **eliminate or restrict Persistent Organic Pollutants (POPs)** such as DDT, PCBs, and dioxins that persist in the environment and accumulate in living organisms.

Convention	Year	Key Issue
Basel Convention	1989	Hazardous waste trade and disposal
Rotterdam Convention	1998	Prior informed consent for hazardous chemicals
Stockholm Convention	2001	Persistent Organic Pollutants (POPs)
Minamata Convention	2013	Mercury pollution control

59. **A keystone species is one whose ecological influence on community structure and ecosystem functioning is disproportionately large relative to its population size. The removal of such species can trigger cascading effects across the ecosystem. In this context, consider the following species:**

1. **Sea otters** – Control sea urchin populations and help maintain kelp forest ecosystems.
2. **Tigers** – Apex predators that regulate herbivore populations and maintain forest ecological balance.
3. **Honey bees** – Important pollinators supporting plant reproduction and biodiversity.
4. **Elephants** – Ecosystem engineers that modify vegetation structure and create habitats for other species.

Which of the above can be considered **keystone species**?
Options:
(a) 1 and 2 only
(b) 2, 3 and 4 only
(c) 1, 2 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(c) 1, 2 and 4 only

📜 **Brief Answer Key**

1. Sea otters: Correct — A classic keystone species that **controls sea urchin populations**, preventing destruction of kelp forests.
2. Tigers: Correct — As **apex predators**, they regulate herbivore populations and maintain trophic balance in forests.
3. Honey bees: Incorrect — Bees are **critical pollinators**, but are generally categorized as **ecosystem service providers rather than keystone species**.
4. Elephants: Correct — Known as **ecosystem engineers**, they alter vegetation patterns and create habitats for many other species.

60. **Foundation species are organisms that play a dominant role in structuring an ecosystem by creating or modifying habitats and providing resources that support numerous other species. In this context, consider the following organisms:**

1. **Mangrove trees** – Stabilize coastal ecosystems and provide breeding and nursery grounds for many marine species.
2. **Coral reefs (reef-building corals)** – Construct reef structures that support highly diverse marine ecosystems.
3. **Elephants** – Modify vegetation and landscapes by creating clearings, dispersing seeds, and forming water holes.
4. **Kelp (giant seaweed)** – Forms dense underwater forests that provide shelter and food for marine organisms.

Which of the above can be considered **foundation species**?

Options:

(a) 1 and 2 only
(b) 2, 3 and 4 only
(c) 1, 2 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**

(c) 1, 2 and 4 only

📄 **Brief Answer Key**

1. Mangrove trees: Correct — Mangroves provide **habitat structure, coastal protection, and nursery grounds** for aquatic species.
2. Coral reefs: Correct — Reef-building corals create **complex reef ecosystems supporting high biodiversity**.
3. Elephants: Incorrect — Elephants are better classified as **ecosystem engineers or keystone species**, not foundation species.
4. Kelp: Correct — Kelp forests form **large underwater habitats that support numerous marine organisms**.

61. **The albedo of a surface refers to the proportion of incoming solar radiation that is reflected back into the atmosphere. Different land surfaces have varying albedo values, which influence local and global climate.**
Consider the following surface types:

1. Fresh snow
2. Desert sand
3. Forest
4. Ocean water

Which of the following correctly represents the decreasing order of albedo (from highest to lowest reflectivity)?

(a) 1 → 2 → 3 → 4
(b) 1 → 3 → 2 → 4
(c) 2 → 1 → 3 → 4
(d) 3 → 2 → 1 → 4

✅ **Correct Answer: (a) 1 → 2 → 3 → 4**

Surface Type	Approximate Albedo
Fresh snow	80–90% (highest reflectivity)
Desert sand	30–40%
Forest	10–20%
Ocean water	5–10% (lowest reflectivity)

Thus, the **correct decreasing order of albedo** is:
Fresh snow → Desert sand → Forest → Ocean water

62. **Facultative mutualism refers to a type of ecological interaction in which two species benefit from each other but are not strictly dependent on the relationship for survival. In this context, consider the following species pairs:**

1. **Honeybee – Sunflower**
2. **Clownfish – Sea Anemone**
3. **Oxpecker bird – African buffalo**
4. **Fig tree – Fig wasp**

Which of the above pairs represent **facultative mutualism**?

Options:

(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**

(b) 1, 2 and 3 only

📄 **Brief Answer Key**

1. Honeybee – Sunflower: Correct — Bees obtain nectar while flowers get pollinated; both benefit but are **not strictly dependent** on each other.
2. Clownfish – Sea Anemone: Correct — Clownfish gain protection from predators while the anemone receives nutrients and cleaning.
3. Oxpecker – African buffalo: Correct — Oxpeckers feed on ticks while buffalo benefit from parasite removal.
4. Fig tree – Fig wasp: Incorrect — This is a classic example of **obligate mutualism**, as both species depend on each other for reproduction.

Interaction Type	Dependence Level	Example
Obligate Mutualism	Species cannot survive without each other	Fig tree – Fig wasp
Facultative Mutualism	Species benefit but can survive independently	Bee – Flower
Commensalism	One benefits, other unaffected	Barnacles – Whale

63. **Parabiosis** is a type of biological association where **two organisms live in close physical contact but do not directly depend on each other for survival**. Unlike mutualism or commensalism, the interaction is often **passive and neither species derives a significant benefit or harm**.
Which of the following species represent **examples of Parabiosis**?

1. **Army Ants and Silverfish**
2. **Sharks and Pilot Fish**
3. **Barnacles on Whales**
4. Hermit Crabs and Sea Anemones

Select the correct answer using the codes below:
A) 1 and 2 only
B) 1, 2, and 3 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4
Correct Answer: B) 1, 2, and 3 only
Explanation:

✓ **Army Ants and Silverfish (Parabiosis)** – Silverfish live **within army ant colonies**, moving with them but **not directly benefiting or harming the ants**.
✓ **Sharks and Pilot Fish (Parabiosis)** – Pilot fish **swim alongside sharks**, using them for protection but **not directly interacting with or affecting the shark**. ✓ **Barnacles on Whales (Parabiosis)** – Barnacles **attach to whale skin**, gaining mobility and food, but the **whale remains unaffected**, making this a passive association.
Hermit Crabs and Sea Anemones (Not Parabiosis – It is Mutualism) – The **sea anemones provide protection** to the hermit crab, while **the crab provides food access to the anemone**, making this **a mutualistic relationship, not parabiosis**.

64. **With reference to marine vegetation in coastal ecosystems, consider the following statements:**

1. **Seagrasses are flowering plants** capable of producing flowers, seeds, and fruits.
2. **Seaweeds (marine macroalgae)** form an important component of marine food webs and serve as food for several marine organisms.
3. The **Gulf of Mannar region** hosts one of the **largest and richest seagrass meadows in India**.

Which of the statements given above is/are correct?
Options:
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

✅ **Correct Answer**
(d) 1, 2 and 3

📄 **Brief Answer Key**
Statement 1: Correct — Seagrasses are **true flowering plants (angiosperms)** adapted to marine environments.
Statement 2: Correct — Seaweeds support marine ecosystems and act as **food for fish, invertebrates, and herbivorous marine species**.

Statement 3: Correct — The **Gulf of Mannar Biosphere Reserve** contains **one of the richest seagrass beds in India**, supporting species such as dugongs.

45. 65. **Epizoics** are organisms that **live on the surface of an animal host** without causing harm. Unlike parasites, they do not extract nutrients from the host but use it **only as a substrate for attachment or movement**.

Which of the following species represent **examples of Epizoics**?

1. **Barnacles on Whales**
2. **Algae on Turtle Shells**
3. **Fleas on Dogs**
4. **Remora Fish on Sharks**

Select the correct answer using the codes below:

A) 1 and 2 only
B) 1, 2, and 4 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4

Correct Answer: B) 1, 2, and 4 only

Explanation:

✓ **Barnacles on Whales (Epizoic)** – Barnacles **attach to whales** to **gain mobility and better access to plankton**, but they do not harm or extract nutrients from the whale.

✓ **Algae on Turtle Shells (Epizoic)** – Certain algae species **grow on sea turtle shells**, using them **only as an attachment surface** without harming the turtle.

Fleas on Dogs (Not Epizoic – It is Parasitism) – Fleas **feed on the blood** of dogs, making them **ectoparasites, not epizoics**.

✓ **Remora Fish on Sharks (Epizoic/Commensalism)** – **Remoras attach to sharks** using a suction disk, gaining **free transport and food scraps**, but they do not harm the shark.

66. A food web is a more complex representation of energy flow in an ecosystem compared to a food chain. Which of the following best represents a **terrestrial food web**?

(a) Grass → Grasshopper → Frog → Snake → Hawk;
(b)Phytoplankton → Zooplankton → Small Fish → Large Fish → Shark
(c) Mushroom → Termite → Lizard → Owl
(d) Neem Tree → Aphid → Butterfly → Crow

Correct Answer:

(a) Grass → Grasshopper → Frog → Snake → Hawk;

Explanation:

A **food web** consists of **multiple interconnected food chains**, showing how different species interact at various trophic levels in an ecosystem.

- **Option (a) is correct** : This represents a **terrestrial food web** because:
  - The first chain: **Grass (Producer) → Grasshopper (Primary Consumer) → Frog (Secondary Consumer) → Snake (Tertiary Consumer) → Hawk (Top Predator)**
  - The second chain: **Grass (Producer) → Rabbit (Primary Consumer) → Fox (Secondary Consumer) → Hawk (Top Predator)**
  - The **hawk** appears in both chains, demonstrating interconnections between species, a key feature of a food web.
- **Option (b) is incorrect** : This is a **linear aquatic food chain**, not a food web.
- **Option (c) is incorrect** : **Mushrooms are decomposers**, not primary producers, and the connection between the species does not form a food web structure.
- **Option (d) is incorrect** : **Butterflies do not consume aphids**, and this does not form a proper **interlinked** food web.

67. An **inverted pyramid of numbers** occurs when the number of individuals increases at higher trophic levels. Which of the following is the best example of an **inverted pyramid of numbers**?

(a) Tree → Caterpillars → Birds → Hawk
(b) Grass → Grasshoppers → Frogs → Snakes → Hawks

(c) Phytoplankton → Zooplankton → Small Fish → Large Fish
(d) Detritus → Earthworms → Frogs → Snakes
Correct Answer:
(a) Tree → Caterpillars → Birds → Hawk
Explanation:
An **inverted pyramid of numbers** is one where **higher trophic levels have a greater number of organisms** than lower levels. This usually occurs in **parasitic** and **forest ecosystems**.

- **Option (a) is correct** : This represents an **inverted pyramid of numbers** in a **forest ecosystem**:
  - **A single large tree (Producer)** supports
  - **Many caterpillars (Primary Consumers)** which feed on its leaves
  - **Fewer birds (Secondary Consumers)** that prey on caterpillars
  - **A single hawk (Tertiary Consumer)** that preys on multiple birds
  - Since the **number of organisms increases at higher levels**, the pyramid is **inverted**.
- **Option (b) is incorrect** : This represents an **upright pyramid of numbers** in a grassland ecosystem, where the number of organisms decreases as we go up the food chain.
- **Option (c) is incorrect** : **An aquatic ecosystem generally forms an upright or spindle-shaped pyramid of numbers**, depending on species survival rates at each trophic level.
- **Option (d) is incorrect** : Detritusbased chains do not necessarily follow an inverted pattern, as decomposer populations vary with environmental conditions.

68. An **upright pyramid of biomass** occurs when the total biomass decreases at higher trophic levels. Which of the following is the best example of an **upright pyramid of biomass**?
(a) Grass → Deer → Tiger
(b) Phytoplankton → Zooplankton → Small Fish → Large Fish
(c) Tree → Caterpillars → Birds → Hawk
(d) Detritus → Earthworms → Frogs → Snakes
Correct Answer: (a) Grass → Deer → Tiger
Explanation:
A **biomass pyramid** represents the total mass of living organisms at each trophic level. An **upright pyramid of biomass** is seen in **terrestrial ecosystems**, where producers (plants) have the highest biomass and top predators have the least.

- **Option (a) is correct** : This represents an **upright pyramid of biomass** in a **terrestrial ecosystem**:
  - **Grass (Producers)** have the largest biomass as they grow in abundance.
  - **Deer (Primary Consumers)** have less biomass than grass, as they consume but do not replace plant biomass at the same rate.
  - **Tiger (Top Predator)** has the least biomass because each tiger requires a vast territory and many prey animals to survive.
  - Since **biomass decreases from producers to top predators**, the pyramid is **upright**.
- **Option (b) is incorrect** : This represents an **inverted pyramid of biomass**, as seen in **aquatic ecosystems**, where **phytoplankton have lower biomass than consumers** due to rapid turnover rates.
- **Option (c) is incorrect** : In **forest ecosystems**, the tree has the largest biomass but supports fewer herbivores, leading to a **partially inverted pyramid of numbers**, not biomass.
- **Option (d) is incorrect** : A detritus-based chain does not necessarily follow an upright biomass pattern, as decomposer biomass varies with available organic matter.

69. Which of the following are correctly matched ?
1. Cartagena Protocol : Bio Safety
2. Montreal Protocol : Ozone Depletion
3. Nagoya Protocol : Differential Responsibility
4. Kyoto Protocol : Benefit Sharing
Select the answer from the below codes
Select the answer from the below codes

a) **1 and 2 only**
b) None of the above
c) 2, 3 and 4 only
d) 1, 2, 3 and 4

Correct Answer : (a) **1 and 2 only**

70. Aquatic ecosystems are divided into distinct zones based on **light penetration, depth, and biological activity**.
Which of the following statements correctly describe the different zones in an aquatic ecosystem?

1. **The Photic Zone is the uppermost layer of water where sunlight penetrates, allowing photosynthesis to occur.**
2. **The Benthic Zone refers to the bottom of a water body, inhabited by decomposers and benthic organisms.**
3. **The Littoral Zone extends from the shoreline to deep open water and is dominated by floating and rooted plants.**
4. **The Limnetic Zone is the deep, dark region of a lake with no light penetration and no photosynthetic activity.**
5. **The Profundal Zone lies below the limnetic zone and receives little to no sunlight, supporting detritus feeders and organisms adapted to low oxygen levels.**

Select the correct answer using the codes below:
A) 1, 2, and 3 only
B) 1, 2, 3, and 5 only
C) 2, 3, 4, and 5 only
D) 1, 2, 3, 4, and 5
Correct Answer: B) 1, 2, 3, and 5 only
Explanation:

✓ Statement 1 (Correct – Photic Zone)
- The **Photic Zone** is the **sunlit upper layer** of water where **photosynthesis occurs**. It supports **phytoplankton, algae, and aquatic plants**.

✓ Statement 2 (Correct – Benthic Zone)
- The **Benthic Zone** is the **bottom surface** of a water body. It contains **decomposers, detritus feeders, and benthic organisms** like worms, bacteria, and bottom-dwelling fish.

✓ Statement 3 (Correct – Littoral Zone)
- The **Littoral Zone** is the **shallow region near the shore**, where **rooted plants like cattails and floating plants like water lilies** thrive.

Statement 4 (Incorrect – Limnetic Zone Misconception)
- The **Limnetic Zone is the open, welllit surface water away from the shore**, **not** a deep, dark zone.
- It **supports phytoplankton, fish, and zooplankton**, making it an important photosynthetic region.

✓ Statement 5 (Correct – Profundal Zone)
- The **Profundal Zone** is **deep and dark, below the limnetic zone**, where **sunlight cannot penetrate**.
- It contains **detritus feeders, bacteria, and low-oxygen-adapted organisms** like some fish species.

71. Which of the following statements regarding pyramid of numbers is correct ?
1. It is mostly upright in pond ecosystem
2. It is always inverted in parasitism
3. It may be neither be inverted nor upright in forest ecosystems
Select the answer from the below codes
(a) 1 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) **All of the above**

.
Correct Answer : (d) All of the above

72. **Certain environmental contaminants are known to cause specific diseases in humans. In this context, consider the following pairs of elements/compounds and the diseases associated with them:**

1. **Cadmium** — Itai-Itai ("Ouch-Ouch") disease
2. **Nitrates** — Methemoglobinemia ("Blue baby syndrome")
3. **Arsenic** — Minamata disease
4. **Methylmercury** — Blackfoot disease

How many of the above pairs are correctly matched?

Options:

(a) Only one pair
(b) Only two pairs
(c) Only three pairs
(d) All four pairs

✅ **Correct Answer**

(b) Only two pairs

📜 **Brief Answer Key**

Pair 1: Cadmium – Itai-Itai disease: Correct — Cadmium poisoning damages bones and kidneys; first identified in Japan.
Pair 2: Nitrates – Methemoglobinemia: Correct — Excess nitrates in drinking water reduce oxygen transport in blood, causing **"blue baby syndrome."**
Pair 3: Arsenic – Minamata disease: Incorrect — Minamata disease is caused by **methylmercury poisoning**, not arsenic.
Pair 4: Methylmercury – Blackfoot disease: Incorrect — Blackfoot disease is linked to **chronic arsenic exposure** in groundwater.

Pollutant	Disease	Key Source
Cadmium	Itai-Itai disease	Industrial pollution
Nitrates	Methemoglobinemia	Fertilizer runoff in groundwater
Methylmercury	Minamata disease	Industrial mercury contamination
Arsenic	Blackfoot disease, arsenicosis	Contaminated groundwater

73. **Necrophages primarily feed on:**

a) Dead and decaying animal flesh
b) Tree bark and plant sap
c) Mushrooms and fungal matter
d) Insects and small arthropods

Correct Answer : (a) **Dead and decaying animal flesh**

74. **With reference to the hierarchical levels of ecological organization, consider the following statements:**

1. A **biome** is a large ecological region consisting of several ecosystems that share broadly similar **climatic conditions and dominant vegetation**.
2. A **population** refers to the interaction of **multiple species within a defined geographical area**.
3. An **ecosystem** includes only the **living (biotic) components** interacting within a particular environment.
4. The **biosphere** represents the highest level of ecological organization, encompassing all ecosystems and the interactions of living organisms with the **atmosphere, hydrosphere, and lithosphere**.

Which of the statements given above is/are correct?

(a) 1 and 4 only
(b) 1, 2 and 3 only
(c) 1, 3 and 4 only
(d) 2 and 3 only

✅ **Correct Answer: (a) 1 and 4 only**

📜 **Brief Answer Key**

Statement 1: Correct — A **biome** includes several ecosystems with similar **climate and vegetation** (e.g., desert biome, tundra biome).
Statement 2: Incorrect — A **population** consists of **individuals of the same species** in

a given area. Interaction among different species forms a **community**.
Statement 3: Incorrect — An **ecosystem includes both biotic and abiotic components** such as soil, water, sunlight, and climate interacting with living organisms.
Statement 4: Correct — The **biosphere** is the **largest ecological level**, integrating all ecosystems and their interaction with Earth's physical systems.

75. **Invasive alien species (IAS) are non-native organisms introduced into ecosystems where they spread rapidly and disrupt native biodiversity and ecological balance. In this context, consider the following species:**

1. *Lantana camara* – A fast-spreading shrub that invades forest ecosystems and suppresses native vegetation.
2. Water hyacinth (*Eichhornia crassipes*) – An aquatic plant that proliferates rapidly and blocks sunlight and oxygen in water bodies.
3. Eucalyptus (*Eucalyptus spp.*) – An introduced tree species widely planted for commercial purposes, often associated with ecological concerns such as soil moisture depletion.
4. Indian cobra (*Naja naja*) – A snake species naturally occurring in Indian ecosystems.

Which of the above can be considered **exotic (non-native) species introduced into India**?
(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ Correct Answer: (b) 1, 2 and 3 only

📜 Brief Answer Key
1. Lantana camara: Correct — Native to Central/South America; one of the **most invasive shrubs in Indian forests**.
2. Water hyacinth: Correct — Native to the **Amazon basin**, now a major invasive aquatic weed in India.
3. Eucalyptus: Correct — Native to **Australia**, introduced for plantations; sometimes considered ecologically problematic though widely cultivated.
4. Indian cobra: Incorrect — **Native species of the Indian subcontinent**, not an exotic species.

Major IAS in India	**Type**
Lantana camara	Terrestrial shrub
Parthenium hysterophorus (Congress grass)	Weed
Eichhornia crassipes (Water hyacinth)	Aquatic plant
Prosopis juliflora	Invasive tree
African catfish (*Clarias gariepinus*)	Invasive fish

76. Variation refers to differences in traits among individuals of the same species arising due to genetic, environmental, or evolutionary factors. In this context, consider the following pairs:

Type of Variation	**Example**
1. Continuous variation	Differences in height among individuals in a human population
2. Discontinuous variation	Ability to roll the tongue in humans
3. Environmental variation	Darkening of moth populations in polluted industrial areas
4. Genetic variation	Differences in eye colour and blood groups among individuals

Which of the pairs given above are correctly matched?
(a) 1 and 2 only
(b) 3 and 4 only
(c) 2, 3 and 4 only
(d) 1, 3 and 4 only

✅ Correct Answer: (c) 2, 3 and 4 only

📜 Brief Answer Key
Pair 1: Incorrect — Continuous variation is best represented by **traits like height or weight**, not tongue rolling.
Pair 2: Correct — **Tongue rolling** is a classic example of **discontinuous variation**, where traits fall into distinct categories.

Pair 3: Correct — The **darkening of moths in polluted areas (industrial melanism)** is influenced by environmental conditions and natural selection.
Pair 4: Correct — **Eye colour and blood groups** are examples of **genetic variation** determined by inherited genes.

Type of Variation	Key Feature	Example
Continuous	Gradual range of traits	Human height
Discontinuous	Distinct categories	Blood groups, tongue rolling
Environmental	Caused by environment	Skin tanning, industrial melanism
Genetic	Caused by inherited genes	Eye colour

77. **Obligate Parasitism** is a type of parasitism where the parasite **cannot complete its life cycle without a host**. These parasites are entirely dependent on their hosts for survival, reproduction, and nutrient supply.
Which of the following species represent **examples of Obligate Parasitism**?
1. **Plasmodium (Malaria Parasite) and Humans**
2. **Rafflesia (Corpse Flower) and Host Plants**
3. **Cuscuta (Dodder Plant) and Host Plants**
4. Fleas and Mammals

Select the correct answer using the codes below:
A) 1 and 2 only
B) 1, 2, and 3 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4
Correct Answer: B) 1, 2, and 3 only
Explanation:
✓ **Plasmodium (Obligate Parasite)** – The **malaria-causing parasite** cannot complete its life cycle without **both human and mosquito hosts**, making it an **obligate parasite**.
✓ **Rafflesia (Obligate Parasite)** – A **holoparasitic plant** that entirely depends on **host plants for nutrients**, as it lacks **roots, stems, and leaves**.
✓ **Cuscuta (Dodder Plant) (Obligate Parasite)** – A **non-photosynthetic plant** that wraps around host plants and **absorbs nutrients via haustoria (specialized parasitic structures)**.
Fleas (Not an Obligate Parasite – It is a Facultative Parasite) – While fleas **depend on hosts for blood meals**, they **can survive for weeks or months without a host**, making them **facultative parasites** rather than obligate parasites.

78. **With reference to different forms of parasitism in ecology, consider the following host–organism pairs associated with *facultative parasitism*:**
1. **Candida fungi – Humans**
2. **Fleas – Mammals**
3. **Bladderwort (*Utricularia*) – Aquatic insects and small invertebrates**
4. **Head louse (*Pediculus humanus capitis*) – Humans**

Which of the pairs given above correctly represent examples of facultative parasitism?
Options:
A. 1 and 2 only
B. 1 and 3 only
C. 2, 3 and 4 only
D. 1, 2, 3 and 4

Correct Answer
✅ **B. 1 and 3 only**

Brief Explanation
What is Facultative Parasitism?
Facultative parasites are organisms that **normally live freely but can adopt a parasitic lifestyle when conditions permit**. They **do not depend entirely on a host to complete their life cycle**.

Pair	Assessment	Explanation
1. Candida – Humans	✅ Correct	*Candida* fungi are usually harmless commensals or free-living microbes but can become

		opportunistic parasites under favorable conditions.
2. Fleas – Mammals	❌ Incorrect	Fleas are **obligate ectoparasites** that require a host for survival and reproduction.
3. Bladderwort – Aquatic insects	✅ Correct	*Utricularia* is a **carnivorous plant** that can survive through photosynthesis but traps insects when nutrients are scarce, making it a facultative nutrient-acquiring strategy.
4. Head louse – Humans	❌ Incorrect	Head lice are **obligate parasites**, entirely dependent on the human host.

Type of Parasitism	**Key Feature**	**Example**
Obligate parasitism	Cannot survive without host	Lice, tapeworm
Facultative parasitism	Normally free-living but can become parasitic	*Candida* fungi
Ectoparasitism	Parasite lives on host surface	Fleas
Endoparasitism	Parasite lives	Roundworms

	inside host	

79. **With reference to the concept of the "Albedo Effect" in climate science, consider the following statements:**

1. Albedo refers to the **fraction of incoming solar radiation that is reflected back into space by a surface**.
2. Surfaces such as **snow and ice have higher albedo** compared to forests and oceans.
3. A decrease in Arctic sea ice tends to **reduce the Earth's overall albedo**, thereby enhancing global warming.

Which of the statements given above is/are correct?

(a) 1 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1, 2 and 3

✅ **Correct Answer: (d) 1, 2 and 3**

📄 **Brief Answer Key**

Statement 1: Correct — Albedo is the **reflectivity of Earth's surface**, indicating how much solar energy is reflected.
Statement 2: Correct — **Snow and ice reflect most sunlight**, whereas darker surfaces like oceans absorb more heat.
Statement 3: Correct — Melting ice exposes darker ocean surfaces, **lowering albedo and accelerating warming**, known as the **ice–albedo feedback**.

80. **With reference to the ice–albedo feedback mechanism in the Earth's climate system, consider the following statements:**

1. The **ice–albedo feedback** is a positive climate feedback mechanism in which melting snow and ice reduce surface reflectivity, causing greater absorption of solar radiation.
2. This mechanism contributes to **Arctic amplification**, where the Arctic warms faster than the global average.

3. The ice–albedo feedback helps **stabilize global temperatures by increasing reflection of solar radiation during warming phases**.
4. Processes such as **glacier retreat and reduction in sea ice extent** can intensify the ice–albedo feedback.

Which of the statements given above are correct?

Options:

(a) 1 and 2 only
(b) 1, 2 and 4 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(b) 1, 2 and 4 only

🪨 **Brief Answer Key**

Statement 1: Correct — Loss of ice reduces reflectivity and increases heat absorption, reinforcing warming.
Statement 2: Correct — Ice–albedo feedback is a key reason for **Arctic amplification**.
Statement 3: Incorrect — It is a **positive feedback**, meaning it amplifies warming rather than stabilizing temperatures.
Statement 4: Correct — **Glacier retreat and sea ice decline** enhance the feedback loop.

81. **With reference to the Kigali Amendment to the Montreal Protocol, consider the following statements:**

1. It is a **legally binding international agreement** aimed at phasing down hydrofluorocarbons (HFCs).
2. **India has ratified the Kigali Amendment** and committed to a phased reduction of HFC consumption and production.
3. Successful implementation of the amendment is expected to **avoid up to about 0.4–0.5°C of global temperature rise by the end of the 21st century**.

Which of the statements given above is/are correct?

Options:

(a) 1 and 3 only
(b) 1, 2 and 3 only
(c) 2 and 3 only
(d) 3 only

✅ **Correct Answer: (b) 1, 2 and 3 only**

🪨 **Brief Answer Key**

Statement 1: Correct — The Kigali Amendment is a **legally binding amendment** to the **Montreal Protocol**, targeting the phasedown of HFCs.
Statement 2: Correct — **India ratified the Kigali Amendment in 2021**, committing to begin HFC phase-down around **2028** under its schedule for developing countries.
Statement 3: Correct — Global implementation could **avoid up to ~0.5°C warming by 2100**, making it a major climate mitigation measure.

82. **Endoparasitism refers to a type of parasitic relationship in which the parasite lives inside the body of the host—within tissues, organs, or cells—deriving nutrients at the host's expense. In this context, consider the following species pairs:**

1. **Plasmodium – Humans**
2. **Tapeworm (*Taenia*) – Cattle/Humans**
3. **Mistletoe – Mango tree**
4. **Leech – Mammals**

Which of the above represent examples of **endoparasitism**?

Options:

(a) 1 and 2 only
(b) 2, 3 and 4 only
(c) 1, 2 and 3 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**
(a) 1 and 2 only

🪨 **Brief Answer Key**

1. Plasmodium – Humans: Correct — The malaria parasite lives **inside red blood cells and liver cells**, making it an endoparasite.
2. Tapeworm (*Taenia*) – Cattle/Humans: Correct — Tapeworms live **inside the host's intestine**, deriving nutrients directly.
3. Mistletoe – Mango tree: Incorrect — Mistletoe is a **plant hemiparasite attached externally** to host plants.
4. Leech – Mammals: Incorrect — Leeches are **ectoparasites**, feeding externally on blood.

Type of Parasitism	Key Feature	Example
Endoparasite	Lives inside host body	*Plasmodium*, Tapeworm
Ectoparasite	Lives on host surface	Leech, Tick
Hemiparasite	Partially parasitic plants	Mistletoe
Parasitoid	Parasite eventually kills host	Parasitic wasps

83. The **Edge Effect** is a phenomenon observed in **Ecotones**, where biodiversity is often higher than in adjacent ecosystems. This occurs because species from both ecosystems interact, leading to unique ecological dynamics.
Which of the following is an example of the **Edge Effect**?

1. **Mangrove forests**
2. **Savanna ecosystems**
3. **Riparian zones (riverbanks)**
4. **Deep-sea hydrothermal vents**

Select the correct answer using the codes below:
A) 1 and 2 only
B) 1, 2, and 3 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4

Correct Answer: B) 1, 2, and 3 only

Explanation:

✓ **Mangrove forests (Edge Effect)** – Mangroves are **coastal ecotones**, where **both marine and terrestrial species** thrive, such as **saltwater crocodiles, mudskippers, and mangrove crabs**.

✓ **Savanna ecosystems (Edge Effect)** – Savannas are **grassland-forest ecotones** where **both open-land and forest-dwelling species** like **giraffes, zebras, and leopards coexist**.

✓ **Riparian Zones (Edge Effect)** – Riverbanks are **ecotones between aquatic and terrestrial habitats**, where **aquatic species (otters, amphibians) and terrestrial species (deer, birds) interact**.

Deep-sea hydrothermal vents (Not an Edge Effect) – Hydrothermal vents exist in **deep ocean zones**, **not** at the boundary between ecosystems. They support **extreme, isolated species** like giant tube worms but **do not represent an ecotone.**

84. Grasslands are major terrestrial ecosystems classified into **Temperate Grasslands** and **Tropical (Hot) Grasslands**, based on **climate, location, and vegetation types**.
Which of the following statements correctly differentiate between **Temperate Grasslands** and **Tropical (Hot) Grasslands**?

1. **Temperate Grasslands experience cold winters and moderate rainfall**, whereas **Tropical Grasslands remain warm throughout the year with distinct wet and dry seasons**.
2. **Temperate Grasslands are found in mid-latitude regions (e.g., Prairies, Pampas, Steppes),** while **Tropical Grasslands are found near the equator (e.g., Savannas of Africa and Campos of Brazil)**.
3. **Temperate Grasslands support large grazing animals such as bison and pronghorns**, while **Tropical Grasslands support herbivores like zebras, giraffes, and elephants**.
4. **Both Temperate and Tropical Grasslands receive high annual rainfall (above 200 cm), making them ideal for dense tree growth.**

Select the correct answer using the codes below:
A) 1 and 2 only
B) 1, 2, and 3 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4
Correct Answer: B) 1, 2, and 3 only
Explanation:
✓ Statement 1 (Correct – Climate Difference)

- **Temperate Grasslands** experience **cold winters and moderate rainfall** (25-75 cm annually).
- **Tropical Grasslands** remain **warm throughout the year** with a distinct **wet season and dry season** (e.g., the African Savanna).

✓ Statement 2 (Correct – Geographic Location)

- **Temperate Grasslands** are found in **mid-latitude regions** such as **the Prairies (North America), Pampas (South America), and Steppes (Eurasia)**.
- **Tropical (Hot) Grasslands** occur **near the equator**, including **Savannas of Africa, Campos of Brazil, and Grasslands of the Deccan Plateau (India)**.

✓ Statement 3 (Correct – Fauna Difference)

- **Temperate Grasslands** support **bison, pronghorn antelope, and prairie dogs**.
- **Tropical Grasslands** support **zebras, giraffes, elephants, lions, and cheetahs**.

Statement 4 (Incorrect – Rainfall Misconception)

- **Temperate Grasslands** receive **low to moderate rainfall (25-75 cm per year)**, which is **not enough to support trees**.
- **Tropical Grasslands receive more rainfall (75-150 cm annually),** but **not above 200 cm**, meaning tree growth is limited.

85. Mountain Ecotones serve as transition zones where **altitudinal gradients create distinct ecological boundaries, impacting species distribution and vegetation structure.**
Which of the following statements correctly describe Mountain Ecotones?

1. **The treeline marks the upper boundary of dense forests, beyond which only shrubs and alpine meadows exist.**
2. **Faunal species in mountain ecotones exhibit high endemism due to geographic isolation and specialized adaptations.**
3. **Mountain ecotones experience temperature inversion, leading to warmer conditions at higher altitudes than in valleys.**
4. **The biodiversity in mountain ecotones decreases gradually with increasing elevation due to declining temperatures and oxygen levels.**

Select the correct answer using the codes below:
A) 1 and 2 only
B) 1, 2, and 4 only
C) 2, 3, and 4 only
D) 1, 2, 3, and 4
Correct Answer: B) 1, 2, and 4 only
Explanation:
✓ **Statement 1 (Correct – Treeline as an Ecotone Marker)** – The **treeline** is the **upper limit of tree growth** in mountain ecosystems, beyond which **alpine meadows, shrubs, and tundra vegetation** dominate.
✓ **Statement 2 (Correct – High Endemism in Mountain Ecotones)** – Due to **geographic isolation**, many mountain species evolve **unique adaptations**, leading to **high endemism** (e.g., Snow Leopard, Himalayan Monal).
Statement 3 (Incorrect – Temperature Inversion Misconception) – While **temperature inversion can occur in valleys**, it does **not make high-altitude regions consistently warmer** than lowlands. **Temperature generally decreases with altitude.**
✓ **Statement 4 (Correct – Biodiversity Decline at Higher Elevations)** – **As altitude increases**, **lower temperatures, high UV exposure, and reduced oxygen levels** limit species diversity, leading to **gradual biodiversity reduction**.

86. Which of the following is an example of a Xylophage?
a) Termites feeding on wood
b) Vultures scavenging carcasses
c) Dung beetles consuming faeces
d) Fungi growing on dead trees

Correct Answer : (a) **Termites feeding on wood**

87. **In aquatic ecosystems, dissolved oxygen levels determine the survival of aquatic organisms and the overall health of water bodies. In this context, which of the**

following statements correctly distinguishes between hypoxic and anoxic conditions?
(a) **Hypoxia** refers to conditions with very low dissolved oxygen, whereas **anoxia** denotes the complete absence of oxygen in water bodies.
(b) **Anoxic conditions** occur in well-oxygenated water bodies, while hypoxia results from excessive oxygen levels.
(c) **Hypoxia** arises due to nutrient deficiency, whereas **anoxia** occurs due to excess oxygen in the water.
(d) **Anoxic conditions** enhance marine biodiversity, while hypoxia leads to an increase in fish populations.

✅ **Correct Answer**
(a) Hypoxia refers to low oxygen levels, while anoxia denotes the complete absence of oxygen.

🗒️ **Brief Answer Key**
Option (a): Correct — **Hypoxia** indicates dissolved oxygen levels typically below ~2 mg/L, while **anoxia** refers to the complete absence of oxygen.
Option (b): Incorrect — Anoxic conditions arise due to **oxygen depletion**, not well-oxygenated water.
Option (c): Incorrect — Hypoxia usually results from **nutrient enrichment and eutrophication**, not nutrient deficiency.
Option (d): Incorrect — Both hypoxic and anoxic conditions are generally **harmful to aquatic life**.

88. **Harmful Algal Blooms (HABs) occur when certain species of algae proliferate rapidly in aquatic ecosystems, often due to nutrient enrichment and favorable environmental conditions. In this context, which of the following statements correctly describes HABs and their ecological impacts?**
(a) Some algal blooms produce **toxins that can harm marine organisms, disrupt aquatic ecosystems, and pose risks to human health**.
(b) Harmful algal blooms enhance fisheries productivity by **increasing dissolved oxygen levels and fish growth**.
(c) Algal blooms occur **only in freshwater lakes** and do not affect marine environments.
(d) Harmful algal blooms arise mainly due to **declining nutrient levels**, which reduces algal populations.

✅ **Correct Answer**
(a) Some algal blooms produce toxins that can harm marine organisms and human health.

🗒️ **Brief Answer Key**
Option (a): Correct — Certain algae (e.g., dinoflagellates and cyanobacteria) produce **toxins** that cause fish kills, shellfish poisoning, and ecosystem disruption.
Option (b): Incorrect — HABs often **reduce dissolved oxygen** and can lead to fish mortality.
Option (c): Incorrect — HABs occur in **both freshwater and marine ecosystems**.
Option (d): Incorrect — HABs are usually triggered by **excess nutrients**, especially nitrogen and phosphorus.

89. **The sulfur cycle is an important biogeochemical cycle involving the movement of sulfur through the atmosphere, lithosphere, hydrosphere, and biosphere. In this context, which of the following statements correctly describes a key process in the sulfur cycle?**
(a) Sulfur circulates in nature mainly through **volcanic emissions, fossil fuel combustion, and microbial transformations** in soil and water.
(b) Plants directly absorb **sulfur dioxide (SO_2)** from the atmosphere and convert it into organic sulfur compounds.
(c) Sulfur does not contribute to the formation of **acid rain** because it remains largely bound in solid compounds.
(d) The sulfur cycle is driven only by geological processes and **does not involve microbial activity**.

✅ **Correct Answer**
(a) Sulfur circulates mainly through volcanic emissions, fossil fuel combustion, and microbial processes.

Brief Answer Key

Option (a): Correct — Sulfur is released through **volcanic eruptions, industrial/fossil fuel combustion, and microbial transformations** in soil and marine environments.

Option (b): Incorrect — Plants primarily absorb sulfur in the form of **sulfate ions (SO_4^{2-})** from the soil, not sulfur dioxide.

Option (c): Incorrect — Sulfur dioxide contributes to **acid rain formation** when it reacts with water to form sulfuric acid.

Option (d): Incorrect — **Microorganisms play a crucial role** in sulfur transformations such as oxidation and reduction.

Process	Description
Volcanic emissions	Release sulfur gases such as SO_2 into the atmosphere
Microbial reduction/oxidation	Bacteria convert sulfur between different chemical forms
Fossil fuel combustion	Major anthropogenic source of SO_2
Acid rain formation	SO_2 reacts with water vapor to form sulfuric acid

90. **With reference to atmospheric aerosols, consider the following statements regarding Brown Carbon (BrC):**

1. Brown carbon has been explored as a potential technological solution for capturing or storing atmospheric carbon dioxide.
2. Brown carbon particles strongly **absorb ultraviolet and visible light**, contributing to atmospheric warming.

Which of the statements given above is/are correct?

Options:

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer

(b) 2 only

Brief Answer Key

Statement 1: Incorrect — Brown carbon is **not a solution for carbon capture**; it is an atmospheric aerosol formed mainly from **biomass burning and organic carbon emissions**.

Statement 2: Correct — Brown carbon absorbs **UV and short visible wavelengths**, contributing to atmospheric warming and affecting climate.

Carbon Type	Source	Climate Effect
Black Carbon	Diesel engines, biomass burning	Strong absorber of sunlight
Brown Carbon	Biomass burning, organic aerosols	Absorbs UV/visible light
Organic Carbon	Secondary organic aerosols	Often scattering aerosols

91. Which of the following correctly describes an important process in the **carbon cycle**?

(a) Plants absorb atmospheric carbon dioxide (CO_2) during photosynthesis and convert it into organic compounds.

(b) Decomposers release oxygen (O_2) into the atmosphere while breaking down dead organic matter.

(c) Animals directly fix atmospheric carbon dioxide (CO_2) and convert it into glucose.

(d) The combustion of fossil fuels reduces the concentration of CO_2 in the atmosphere.

Correct Answer:

(a) Plants absorb atmospheric carbon dioxide (CO_2) during photosynthesis and convert it into organic compounds.

Explanation:

The **carbon cycle** is the process by which carbon moves between the atmosphere, biosphere, hydrosphere, and geosphere.

- **Option (a) is correct** :
  - **Plants absorb CO_2 from the atmosphere** during **photosynthesis**.

- They **convert CO_2 into glucose ($C_6H_{12}O_6$)**, which is used for growth and energy storage.
- This is a key process in the carbon cycle, ensuring carbon flows from the atmosphere into the biosphere.

- **Option (b) is incorrect** : Decomposers **release CO_2, not O_2**, during the breakdown of organic matter through respiration.
- **Option (c) is incorrect** : Animals **cannot fix atmospheric CO_2**; only photosynthetic organisms (like plants, algae, and cyanobacteria) do this.
- **Option (d) is incorrect** : The **combustion of fossil fuels increases CO_2 levels**, contributing to the greenhouse effect, not reducing CO_2.

92. **Climate change can result from both natural processes and human activities that alter the Earth's energy balance and atmospheric composition. In this context, consider the following factors:**

1. Ocean currents
2. Volcanic activity
3. Industrial Revolution and large-scale fossil fuel combustion
4. Sunspot cycles
5. Variations in solar irradiance

Which of the above can influence **climate change**?

Options:

(a) 1, 2 and 4 only
(b) 1, 2, 3 and 4 only
(c) 2 and 4 only
(d) 1, 2, 3, 4 and 5

✅ **Correct Answer**

(d) 1, 2, 3, 4 and 5

🧻 **Brief Answer Key**

1. Ocean currents: Correct — They redistribute heat across the planet and influence global climate patterns.
2. Volcanic activity: Correct — Volcanic eruptions release aerosols and gases that can alter atmospheric temperature.
3. Industrial Revolution: Correct — Large-scale fossil fuel combustion has increased **greenhouse gas concentrations**, driving modern climate change.
4. Sunspot cycles: Correct — Variations in solar magnetic activity affect solar radiation reaching Earth.
5. Solar irradiance: Correct — Changes in the Sun's energy output influence Earth's climate system.

93. Which of the following best describes the concept of **Ecological Footprint**?

(a) The measure of human demand on natural resources and ecosystems in terms of biologically productive land and water required to sustain consumption and absorb waste.
(b) The total carbon emissions produced by a country, calculated annually based on industrial output and transportation use.
(c) The number of species that go extinct due to human activities in a given ecosystem over a specific period.
(d) The amount of oxygen consumed by organisms in a given area, used to assess ecosystem productivity.

Correct Answer:

(a) The measure of human demand on natural resources and ecosystems in terms of biologically productive land and water required to sustain consumption and absorb waste.

Explanation:

The **Ecological Footprint** is an important sustainability metric that measures **how much natural resources humans consume** compared to Earth's ability to regenerate those resources. It is expressed in **global hectares (gha)** and considers factors like land use, carbon emissions, and resource consumption.

- **Option (a) is correct** :
  - The **Ecological Footprint** calculates the **biologically productive land and water area needed** to support human activities, including food production, energy consumption, and waste management.

- It helps determine whether humanity is **living within the planet's ecological limits**.
- If the footprint exceeds Earth's biocapacity, it leads to **ecological overshoot**, meaning **resource depletion and environmental degradation**.

- **Option (b) is incorrect** : Carbon emissions are part of the **carbon footprint**, which is a subset of the **ecological footprint**, but not the full definition.
- **Option (c) is incorrect** : The **extinction of species** is related to **biodiversity loss**, but it does not define the **ecological footprint**.
- **Option (d) is incorrect** : Oxygen consumption is related to **biological oxygen demand (BOD)** and **ecosystem productivity**, but not to the measurement of human impact on Earth's resources.

94. **Marine upwelling is an oceanographic process in which deep, cold, and nutrient-rich waters rise to the ocean surface, significantly influencing marine productivity. In this context, consider the following statements:**

1. Some of the **most biologically productive marine regions of the world** occur in areas where upwelling takes place.
2. Upwelling **brings nutrient-rich deep waters to the surface**, supporting phytoplankton growth.
3. Upwelling currents generally **transport fish larvae away from coastal regions**, reducing coastal fish populations.

Which of the statements given above is/are correct?

Options:

(a) 1 and 2 only
(b) 2 only
(c) 2 and 3 only
(d) 1, 2 and 3 only

✅ **Correct Answer**

(a) 1 and 2 only

📄 **Brief Answer Key**

Statement 1: Correct — Upwelling regions support **very high primary productivity**, forming some of the world's richest fishing grounds.
Statement 2: Correct — Nutrient-rich deep water containing **nitrates, phosphates, and silicates** rises to the surface, stimulating phytoplankton growth.
Statement 3: Incorrect — Upwelling **generally enhances fish productivity near coasts**, rather than transporting larvae away.

95. Which of the following expressions best expresses an organism's functional place in the community of organisms as well as the physical space it occupies?

a) Ecotone
b) Trophic level
c) Ecocline
d) Ecological niche

Correct Answer : d) Ecological niche

96. What percentage of the global land surface is covered by peatlands, and how much carbon do they store?

(a) 1% of the land surface; 50 billion tonnes of carbon
(b) 5% of the land surface; 300 billion tonnes of carbon
(c) 10% of the land surface; 150 billion tonnes of carbon
(d) 3% of the land surface; nearly 550 billion tonnes of carbon

Answer: (d) 3% of the land surface; nearly 550 billion tonnes of carbon.

97. **With reference to the distribution of ozone in the Earth's stratosphere, consider the following statements:**

1. The **rate of ozone formation is highest in the tropical stratosphere** due to intense solar ultraviolet radiation.
2. Despite higher ozone production in the tropics, the **total ozone concentration over tropical regions is relatively lower** than in higher latitudes.
3. The **mid-latitude regions experience the lowest ozone concentrations throughout the year**.

4. **Significant thinning of the ozone layer** is commonly observed in the polar regions.

Which of the statements given above are correct?

Options:

(a) 1 and 2 only
(b) 1, 2 and 4 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

✅ **Correct Answer**

(b) 1, 2 and 4 only

📄 **Brief Answer Key**

Statement 1: Correct — Strong **UV radiation in tropical regions drives ozone formation** in the stratosphere.
Statement 2: Correct — Atmospheric circulation transports ozone **from the tropics toward mid and high latitudes**, leading to lower total ozone over the tropics.
Statement 3: Incorrect — **Mid-latitudes usually have higher ozone concentrations**, not the lowest.
Statement 4: Correct — Severe seasonal ozone depletion occurs in polar regions, especially the **Antarctic ozone hole**.

98. Match the **Nitrogen-Fixing Bacteria** (Column I) with their **Scientific Name** (Column II) and **Function** (Column III).

Column I (Type of Bacteria)	**Column II (Bacteria Name)**	**Column III (Function)**
A. Free-living nitrogenfixing bacteria	1. Rhizobium	P. Converts atmospheric nitrogen (N_2) into ammonia (NH_3) in root nodules of legumes
B. Symbiotic nitrogenfixing bacteria	2. Nitrobacter	Q. Converts atmospheric nitrogen (N_2) into ammonia (NH_3) in the soil independently
C. Cyanobacteria (Blue-green algae)	3. Nostoc	R. Fixes nitrogen in aquatic environments through photosynthesis
D. Nitrifying bacteria	4. Azotobacter	S. Converts nitrites (NO_2^-) into nitrates (NO_3^-)

Which of the following correctly matches Column I, Column II, and Column III?

(a) A - 1 - Q, B - 2 - P, C - 3 - R, D - 4 - S **(b)** A - 2 - Q, B - 4 - P, C - 3 - S, D - 1 - R
(c) A - 4 - Q, B - 1 - P, C - 3 - R, D - 2 - S
(d) A - 3 - R, B - 2 - Q, C - 1 - P, D - 4 - S

Correct Answer:

(c) A - 4 - Q, B - 1 - P, C - 3 - R, D - 2 - S

Explanation:

- **Option (c) is correct** :
  - **A - 4 - Q**: *Azotobacter* is a **free-living nitrogen-fixing bacteria**, converting atmospheric nitrogen into ammonia in soil.
  - **B - 1 - P**: *Rhizobium* is a **symbiotic nitrogen-fixing bacteria**, found in legume root nodules, fixing nitrogen into ammonia.
  - C - 3 - R: *Nostoc* is a **cyanobacterium**, fixing nitrogen in aquatic ecosystems through photosynthesis.
  - **D - 2 - S**: *Nitrobacter* is a **nitrifying bacteria**, converting nitrites (NO_2^-) into nitrates (NO_3^-), aiding plant absorption.

99. What is the role of Azotobacter, Clostridium and Rhizobium in Nitrogen Cycle ?

a) Ammonifying Bacteria
b) Nitrifying Bacteria
c) Nitrogen Fixing Bacteria
d) Denitrifying Bacteria

Correct Answer : c) Nitrogen Fixing Bacteria

100. Match the following types of speciation with their corresponding definitions and examples:

List I (Type of Speciation)	List II (Definition)	List III (Example)
A. Allopatric Speciation	1. Speciation due to strong environmental gradients across a continuous population range	a. Darwin's finches diverging after isolation on different Galápagos islands
B. Sympatric Speciation	2. Formation of new species within the same geographical area due to ecological or genetic differences	b. Apple maggot flies evolving host preference within the same region
C. Peripatric Speciation	3. Evolution of a small isolated population at the periphery of a larger population	c. Small founder populations evolving on isolated islands
D. Parapatric Speciation	4. Formation of species due to geographic isolation by physical barriers	d. Grass species adapting to metal-contaminated soils near mines

Select the correct code:
(a) A-4-a, B-2-b, C-3-c, D-1-d
(b) A-2-a, B-4-b, C-3-c, D-1-d
(c) A-4-b, B-2-a, C-1-c, D-3-d
(d) A-3-a, B-2-d, C-4-b, D-1-c

✅ **Correct Answer: (a) A-4-a, B-2-b, C-3-c, D-1-d**

📄 **Brief Answer Key**

Allopatric speciation: Occurs due to **geographic isolation** (e.g., Darwin's finches).
Sympatric speciation: Occurs **within the same geographic area**, often through **ecological specialization or genetic change**.
Peripatric speciation: Happens when a **small isolated peripheral population diverges** from the main population (founder effect).
Parapatric speciation: Occurs when populations evolve separately **along environmental gradients without complete geographic isolation**.

Type	Key Mechanism
Allopatric	Geographic isolation
Sympatric	Speciation in same location
Peripatric	Founder effect in small isolated population
Parapatric	Divergence across environmental gradient