CUET UG 2026 Environmental Science May 15 Shift 1 Question Paper with Solutions PDF

Question Paper with Solutions

Conducted by the National Testing Agency (NTA)

Time Allowed: 60 Minutes **Maximum Marks: 250**

General Instructions

(i) This is the Environmental Science question paper of CUET (UG) 2026, conducted by the National Testing Agency (NTA) in Computer Based Test (CBT) mode.

(ii) The paper contains 50 multiple choice questions. All questions are compulsory.

(iii) The duration of this test paper is 60 minutes. The maximum score is 250 marks.

(iv) Each question has four options. Select the one correct answer for each question.

(v) Marking scheme: $+5$ marks for a correct answer, -1 mark for an incorrect answer, and 0 marks for an unanswered question.

Environmental Studies (250 marks)

1. Match List-I with List-II.

List-I (Sustainable Development Goal number as per UNSDGs-17 List)	List-II (Objective)
(A) Ten	(I) Life below water
(B) Fourteen	(II) Life on land
(C) Fifteen	(III) Reduced Inequalities
(D) Sixteen	(IV) Peace, justice and strong institutions

Choose the correct answer from the options given below: [5 marks]

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

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

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

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

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

Solution:

Concept:

- The United Nations Sustainable Development Goals are a numbered set of 17 goals. A matching question requires the official number and objective of each goal, rather than an association based only on similar words.
- Goal 10 concerns reduced inequalities; Goals 14 and 15 distinguish aquatic life from terrestrial life; Goal 16 concerns peace, justice and strong institutions.

Step 1: Match the social and institutional goals Ten is SDG 10, Reduced Inequalities, so A matches III. Sixteen is SDG 16, Peace, Justice and Strong Institutions, so D matches IV. These are distinct objectives: reducing inequality is not the goal entitled Life below Water. Establishing A–III immediately rules out options (A) and (D), both of which incorrectly give A–I.

Step 2: Separate the two biodiversity goals Fourteen is SDG 14, Life below Water, covering conservation and sustainable use of oceans, seas and marine resources. Therefore B matches I. Fifteen is SDG 15, Life on Land, covering terrestrial ecosystems and biodiversity. Therefore C matches II. Option (B) reverses these two objectives, assigning Life on Land to fourteen and Life below Water to fifteen. Only option (C) retains the correct assignments for all four entries.

Step 3: Conclusion The matching is A–III, B–I, C–II and D–IV. Hence, the correct option is (C).

Quick Tip to Solve: Remember the consecutive pair: SDG 14 is water and SDG 15 is land; then check the social goals separately.

2. Match List-I with List-II.

List-I	List-II
(A) Stewardship of land	(I) Capitalism is the real cause of environmental degradation
(B) Shallow Ecology	(II) Hierarchical and class system are responsible for environmental degradation.
(C) Social Ecology	(III) Responsible planning and management of resources.
(D) Socialist Ecology	(IV) Conserve environment only to meet human needs.

Choose the correct answer from the options given below: [5 marks]

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

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

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

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

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

Solution:

Concept:

- Environmental philosophies differ in their explanation of ecological damage and their reasons for protecting nature. Matching them requires identifying each approach's central concern.
- Stewardship stresses responsible care, shallow ecology places human needs at the centre, social ecology examines social hierarchy, and socialist ecology criticises capitalist production.

Step 1: Identify stewardship and shallow ecology Stewardship of land means accepting responsibility for its care and use. Responsible planning and management of resources is therefore its direct definition, giving A–III. Shallow ecology is anthropocentric: it supports conservation primarily for human welfare and needs, rather than treating every form of life as having equal intrinsic value. This gives B–IV. Option (D) incorrectly exchanges these two definitions; options (A) and (B) also assign stewardship to a critique of an economic or social system rather than responsible management.

Step 2: Distinguish the two social critiques Social ecology links domination of nature with domination within society. Its focus on hierarchy and class relations gives C–II. Socialist ecology identifies capitalism and its production relationships as a fundamental cause of environmental degradation, giving D–I. Although the two approaches both examine society, the question distinguishes a broad critique of hierarchical relations from the explicit critique of capitalism. Combining these matches with the first pair selects only option (C).

Step 3: Conclusion The matching is A–III, B–IV, C–II and D–I. Hence, the correct option is (C).

Quick Tip to Solve: Link stewardship with care, shallow ecology with human needs, social ecology with hierarchy, and socialist ecology with capitalism.

3. First "Earth Day" was celebrated on _____. [5 marks]

(A) April 20, 1970

(B) April 22, 1970

(C) April 20, 1972

(D) April 22, 1972

Correct Answer: (B) April 22, 1970

Solution:

Concept:

- Earth Day is an environmental awareness observance associated with the modern environmental movement. Its first celebration took place on 22 April 1970.
- A historical-date question requires both the correct day and the correct year. Selecting an option with only one of those elements correct is insufficient.

Step 1: Recall the founding Earth Day event The first Earth Day was celebrated in the United States on 22 April 1970 as a large public mobilisation for environmental protection. The initiative brought environmental concerns into public discussion through activities and educational events. The date to retain is therefore 22 April, with 1970 as the founding year. This identifies the historical event asked for, rather than a later anniversary or a different environmental observance.

Step 2: Check the day and year in every option Option (B), April 22, 1970, matches both parts of the founding date. Option (A) has the correct year but substitutes April 20 for April 22. Option (C) has both the wrong day and the wrong year. Option (D) retains April 22 but gives 1972, two years after the first celebration. Thus neither choosing the right month alone nor recognising 1970 alone is enough; the complete date singles out option (B).

Step 3: Conclusion The first Earth Day was celebrated on 22 April 1970. Hence, the correct option is (B).

Quick Tip to Solve: Memorise Earth Day as 22 April 1970, checking the day and year separately when the options contain similar dates.

4. Which of the following issue is NOT addressed by Eco-feminism? [5 marks]

(A) Animal rights

(B) Agriculture development

(C) Air Pollution

(D) Nuclear weapon policies

Correct Answer: (C) Air Pollution

Solution:

Concept:

- Eco-feminism examines connections between the domination of women and the exploitation of nature. It extends ethical and political criticism to patterns of domination affecting people, other animals and ecosystems.
- The question asks for the issue NOT addressed in the conventional grouping of eco-feminist concerns. It tests recognition of that grouping, rather than whether a topic can have any environmental or gender implications.

Step 1: Identify the recognised eco-feminist concerns Animal rights connects with eco-feminist criticism of domination and the treatment of other living beings as resources for exploitation. Agricultural development is connected with women's work, access to land, control over seeds and resources, and ecological farming practices. Nuclear weapon policies connect with eco-feminist peace and anti-militarist concerns, including the destructive consequences of militarised power. Options (A), (B) and (D) therefore belong to the issues addressed in this classification and cannot answer the negative question.

Step 2: Select the remaining issue Air pollution is ordinarily classified as a problem of atmospheric contamination, emissions and pollution control. Among these four alternatives it is the issue outside the conventional list of eco-feminist concerns being tested. This does not mean that eco-feminists cannot discuss unequal exposure to polluted air; environmental philosophies can overlap with many practical problems. The required distinction is the conventional association of the listed issues with eco-feminism, for which air pollution is the exception.

Step 3: Conclusion Air pollution is the exception among the listed issues in this classification. Hence, the correct option is (C).

Quick Tip to Solve: Underline NOT, then identify eco-feminism's familiar links with animal ethics, women's agricultural roles and anti-nuclear activism.

5. Which of the following formula is correct to calculate "the average rate of change in the number of organisms per time, per organisms", in population growth rate ?

Where, N represent the number of organisms and t is the time. [5 marks]

(A) ΔN

(B) $\dfrac{\Delta N}{N\,\Delta t}$

(C) $\dfrac{\Delta N}{\Delta t}$

(D) $\dfrac{\Delta t}{N\,\Delta N}$

Correct Answer: (B) $\dfrac{\Delta N}{N\,\Delta t}$

Solution:

Concept:

- The absolute population growth rate measures the change in population size per unit time. If the size changes by ΔN during an interval Δt, its average value is $\Delta N/\Delta t$.
- A per-capita rate expresses the same change per organism, so the absolute rate must also be divided by population size N. This distinguishes population growth from growth per member.

Step 1: Translate the words into a rate First interpret "per time": divide the change in the number of organisms by the elapsed time. This gives the average absolute increase or decrease in the population. The question additionally says "per organisms", which asks for normalization by the number of individuals contributing to that change. Thus an absolute increase alone does not answer the entire question.

Step 2: Divide by the population size The required average per-capita rate is therefore

$$r_{\text{av}} = \frac{1}{N}\frac{\Delta N}{\Delta t} = \frac{\Delta N}{N\,\Delta t}.$$

Here the same reference population size must be used consistently over the stated interval. Its units are inverse time, since the organism count in the numerator cancels the organism count in the denominator.

Step 3: Eliminate the other expressions Option (A), ΔN, is only a change in number and contains no time interval. Option (C), $\Delta N/\Delta t$, is the absolute rate and lacks division by N. Option (D) puts time in the numerator and the change in the denominator, so it is not the specified growth rate.

Step 4: Conclusion The average rate of population change per organism is $\Delta N/(N\,\Delta t)$. Hence, the correct option is (B).

Quick Tip to Solve: Translate each "per" into a division: per time supplies a time denominator, and per organism supplies the population-size denominator.

6. Arrange the following forest types according to latitudinal zonation from equator towards poles A. Deciduous Forest B. Coniferous Forest C. Grassland D. Tundra Forest E. Tropical rain Forest Choose the correct answer from the options given below: [5 marks]

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

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

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

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

Correct Answer: (C) E, C, A, B, D

Solution:

Concept:

- Broad latitudinal patterns of vegetation reflect changes in solar energy, temperature and moisture from the equator toward the poles.
- In the simplified sequence of the listed biomes, tropical rain forest is followed by grassland, deciduous forest, coniferous forest and tundra. Local rainfall and continental geography can modify actual distributions.

Step 1: Locate the warmest and coldest ends Begin with E, the tropical rain forest, which is associated with warm, moist equatorial conditions and luxuriant vegetation. At the opposite end is D, tundra, where cold temperatures and a short growing season prevent the formation of tall closed forests. Although the question calls it "Tundra Forest", the tundra biome is characteristically treeless.

Step 2: Place the intermediate vegetation zones Moving poleward in the generalized zonation represented by the options, the grassland zone C comes after tropical rain forest. Deciduous forest A occupies temperate conditions, while the coniferous forest B is characteristic of the colder boreal region before tundra. The sequence is

$$E \longrightarrow C \longrightarrow A \longrightarrow B \longrightarrow D.$$

Step 3: Check the proposed sequences Options (A) and (B) begin with grassland rather than the equatorial tropical rain forest, so neither has the correct starting point. Option (D) begins correctly but places coniferous forest before deciduous forest on a journey toward the poles. Option (C) alone preserves both the correct warm-to-cold endpoints and the required order of these two forest zones.

Step 4: Conclusion The order is tropical rain forest, grassland, deciduous forest, coniferous forest and tundra: E, C, A, B, D. Hence, the correct option is (C).

Quick Tip to Solve: Anchor tropical rain forest at the equator and tundra at the poles, then place deciduous forest before colder boreal coniferous forest.

7. Arrange the following ecological succession in the lithosphere (rocks) from final to initial succession stage A. Moss stage B. Foliose - lichens stage C. Herbaceous stage D. Crustose - lichens Stage E. Shrub stage Choose the correct answer from the options given below: [5 marks]

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

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

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

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

Correct Answer: (C) E, C, A, B, D

Solution:

Concept:

- A lithosere is primary ecological succession beginning on bare rock. Pioneer lichens promote weathering and help initiate the accumulation of material from which soil develops.
- The usual forward order among the listed stages is crustose lichens, foliose lichens, mosses, herbs and shrubs. A question asking for final-to-initial order requires the reverse of this sequence.

Step 1: Establish the forward succession Crustose lichens D are pioneers on exposed rock because they can adhere closely to the surface and tolerate the initially severe conditions. Their activity contributes to weathering. Foliose lichens B follow as the developing substrate becomes more suitable; their larger thalli contribute additional organic matter. Mosses A then grow where moisture retention and accumulated material have improved.

Step 2: Continue to the later listed stages With a deeper and more developed soil, herbaceous plants C can establish, followed by shrubs E. Thus the initial-to-final order of the stages actually supplied is

$$D \longrightarrow B \longrightarrow A \longrightarrow C \longrightarrow E.$$

A later tree or climax stage is not among the choices and need not be inserted.

Step 3: Reverse the sequence and compare the options The question explicitly asks for final to initial, so reverse the established order to obtain E, C, A, B, D. Option (A) incorrectly places crustose lichens before mosses in this reverse journey. Option (B) reverses the relative positions of mosses and foliose lichens. Option (D) reverses the relative positions of the two lichen stages. Only option (C) retains every required relationship.

Step 4: Conclusion The requested reverse order is shrub, herbaceous, moss, foliose-lichen and crustose-lichen stages: E, C, A, B, D. Hence, the correct option is (C).

Quick Tip to Solve: Write the rock-to-shrub succession first; reverse the entire list only after checking whether the question asks for initial-to-final or final-to-initial order.

8. Which of the following ecological pyramid is always inverted? [5 marks]

(A) Pyramid of Number in Grassland ecosystem

(B) Pyramid of Number in Parasitic food chain

(C) Pyramid of Biomass in forest ecosystem

(D) Pyramid of energy in grassland ecosystem

Correct Answer: (B) Pyramid of Number in Parasitic food chain

Solution:

Concept:

- A pyramid of numbers represents the number of individual organisms at successive trophic levels, rather than their combined mass or the energy passing through them.
- In a parasitic food chain, a small number of hosts can support many parasites, and parasites can support still more hyperparasites. This produces an inverted numerical relationship.

Step 1: Identify the pyramid with increasing organism counts A parasitic food chain may begin with one large host supporting numerous parasites. At a further parasitic level, many smaller hyperparasites can be supported by those parasites. Because the number of organisms increases from the host level toward the parasitic levels, the lower level is narrow and the higher levels are broader. This is the inverted pyramid of numbers specified in option (B).

Step 2: Check the grassland number and forest biomass alternatives In a grassland ecosystem, numerous grasses support fewer herbivores, which in turn support still fewer carnivores. Its conventional pyramid of numbers is upright, so option (A) does not qualify. In a forest ecosystem the large standing biomass of producer trees generally exceeds that of the consumers; the biomass pyramid is upright. Option (C) is therefore also incorrect.

Step 3: Use energy flow to reject the final option Energy is dissipated during transfer between trophic levels, with much of it ultimately released as heat through metabolic processes. Successive levels therefore receive less energy than the preceding level. A pyramid of energy is always upright, including in grassland, so option (D) cannot be inverted. Do not confuse energy flow with organism number: one large host can nourish many small parasites without creating additional energy.

Step 4: Conclusion The pyramid of numbers in a parasitic food chain is inverted. Hence, the correct option is (B).

Quick Tip to Solve: Keep the measured quantity clear: many small parasites on a few large hosts invert numbers, but energy pyramids remain upright.

9. Diversity of habitat over the total landscape or geographical area is referred to as _____

[5 marks]

(A) Genetic diversity

(B) Alfa diversity

(C) Beta diversity

(D) Gamma diversity

Correct Answer: (D) Gamma diversity

Solution:

Concept:

- Biodiversity can be measured at genetic, local-community and regional scales. The geographical scale named in the question determines the appropriate term.
- Alpha diversity describes diversity within a habitat; beta diversity describes differences between habitats; gamma diversity describes the overall diversity of a landscape or region.

Step 1: Identify the scale in the statement The statement refers to the total landscape or geographical area rather than a single community. A landscape can contain several habitats and their associated communities, so the required measure must encompass the whole region.

Step 2: Distinguish the other levels Gamma diversity is the regional total. Genetic diversity instead concerns variation in genes within a species, so (A) does not describe habitat-level diversity. Alpha diversity, printed as Alfa in (B), is local diversity. Beta diversity in (C) concerns the turnover or change in species composition between habitats, rather than the overall regional diversity.

Step 3: Conclusion The diversity at the scale of the whole landscape or geographical region is gamma diversity. Hence, the correct option is (D).

Quick Tip to Solve: Associate alpha with one habitat, beta with change between habitats, and gamma with the whole geographical region.

10. Parasites, that feed on external surface of the host organism are called_____. [5 marks]

(A) Endo parasites

(B) Brood parasites

(C) Ecto parasites

(D) Commens parasites

Correct Answer: (C) Ecto parasites

Solution:

Concept:

- Parasitism is an interaction in which a parasite obtains nourishment from a host and harms it. Parasites can be classified by where they live or feed relative to the host.
- The prefix ecto- means outside, whereas endo- means inside. Ectoparasites feed on the external surface of a host.

Step 1: Locate the feeding site The decisive words are external surface. Organisms such as lice

on humans or ticks on mammals obtain resources while remaining on the outside of the host. This location identifies them as ectoparasites.

Step 2: Eliminate the alternatives Endoparasites in (A) live inside the host, for example in its digestive tract or tissues, so they contradict the specified location. Brood parasites in (B) exploit another animal's parental care, as when a cuckoo lays eggs in another bird's nest; this is not a category defined by surface feeding. The expression Commens parasites in (D) does not name the standard external-feeding category; commensalism also involves no harm to the other species.

Step 3: Conclusion Parasites feeding on the external surface of the host are ectoparasites. Hence, the correct option is (C).

Quick Tip to Solve: Use the location clue: ecto- means outside the host and endo- means inside the host.

11. Commensalism is a kind of population interaction, in which _____. [5 marks]

(A) Both the species are benenfitted.

(B) One species is benefitted and other is harmed.

(C) One species is benefitted and other is unaffected.

(D) Both the species are harmed.

Correct Answer: (C) One species is benefitted and other is unaffected.

Solution:

Concept:

- Population interactions are classified by their effects on the two participating species. A benefit is represented by a plus sign, harm by a minus sign and no significant effect by zero.
- Commensalism has the interaction pattern $+, 0$: one species benefits while the other is neither significantly helped nor harmed.

Step 1: Apply the definition In commensalism, one organism gains a resource or advantage, such as support, shelter or access to food. The other organism is unaffected. An orchid growing as an epiphyte on a tree illustrates this pattern: the orchid obtains support without taking food from the tree.

Step 2: Compare all stated interactions Option (C) gives exactly the benefit-and-no-effect pattern. Both species benefiting in (A) describes mutualism, not commensalism. One species benefiting while the other is harmed in (B) describes an interaction such as parasitism or predation. Both species being harmed in (D) represents a negative-negative interaction such as competition. None of these three patterns has the unaffected partner required here.

Step 3: Conclusion One species is benefitted and the other is unaffected in commensalism. Hence, the correct option is (C).

Quick Tip to Solve: For interaction questions, write the signs first: commensalism is $+, 0$, mutualism is $+, +$, and parasitism is $+, -$.

12. Which of the following are criteria air pollutants under NAAQS in India? A. CO B. CO2 C. NO2 D. SO2 E. Pb Choose the correct answer from the options given below: [5 marks]

(A) A, B, C and D only

(B) B, C, D and E only

(C) A, C, D and E only

(D) A, C and E only

Correct Answer: (C) A, C, D and E only

Solution:

Concept:

- India's National Ambient Air Quality Standards (NAAQS) specify ambient concentration limits for listed air pollutants. A substance being environmentally important does not by itself mean it is included in this standards list.
- Carbon monoxide, nitrogen dioxide, sulphur dioxide and lead are included in the NAAQS pollutant list. Carbon dioxide is a greenhouse gas but is not one of the listed NAAQS criteria pollutants.

Step 1: Assess each listed substance A is carbon monoxide (CO), C is nitrogen dioxide (NO_2), D is sulphur dioxide (SO_2), and E is lead (Pb). Each belongs to the Indian NAAQS list. B is carbon dioxide (CO_2); although its increasing atmospheric concentration contributes to climate change, it is not included in this particular ambient-air standards list.

Step 2: Select the complete combination The required letters are therefore A, C, D and E. Option (C) includes all four and excludes B. Option (A) includes carbon dioxide and omits lead. Option (B) includes carbon dioxide and omits carbon monoxide. Option (D) excludes carbon dioxide correctly but also leaves out sulphur dioxide, which is a listed pollutant. Thus only one offered combination matches the entire set.

Step 3: Conclusion CO, NO_2, SO_2 and Pb are included, giving A, C, D and E only. Hence, the correct option is (C).

Quick Tip to Solve: Separate greenhouse-gas relevance from NAAQS membership: exclude CO_2 here, but retain CO, NO_2, SO_2 and lead.

13. Arrange the following in increasing order of their sand content A. Sandy soil B. Silty Soil C. Clayey soil D. Loamy soil Choose the correct answer from the options given below: [5 marks]

(A) C, D, B, A

(B) C, B, D, A

(C) A, D, B, C

(D) B, C, D, A

Correct Answer: (B) C, B, D, A

Solution:

Concept:

- Soil texture depends on the relative proportions of sand, silt and clay particles. Sand is the coarsest of these mineral fractions, while clay is the finest.
- For the usual school-level comparison of the named soil types, sand content increases from clayey through silty and loamy to sandy soil. Loam contains a balanced mixture rather than being dominated by the finest fraction.

Step 1: Identify the two ends of the sequence Clayey soil, labelled C, is dominated by fine clay particles and represents the lowest sand content in this comparison. Sandy soil, labelled A, contains the greatest proportion of sand, so it must come last in an increasing sequence. This immediately rules out the sequence starting with A and also the sequence starting with B. We must now distinguish the two options that both begin with C and end with A.

Step 2: Place the intermediate soils Silty soil, labelled B, is dominated by the intermediate-sized silt fraction. Loamy soil, labelled D, has a mixed texture with a substantial sand component along with silt and clay. In the conventional comparison intended here, silty soil therefore precedes loamy soil as sand content increases. Combining this with the two end members gives clayey, silty, loamy, sandy: C, B, D, A.

Step 3: Compare the complete options Option (B) has precisely this order. Option (A) reverses the positions of silty and loamy soils. Option (C) puts sandy soil first and clayey soil last, reversing the required direction. Option (D) places silty soil before clayey soil, so it does not begin with the least sandy member. Soil texture names describe ranges of composition, but this question uses their standard qualitative comparison.

Step 4: Conclusion The increasing order of sand content is C, B, D, A: clayey soil, silty soil, loamy soil and sandy soil. Hence, the correct option is (B).

Quick Tip to Solve: First fix clayey soil at the low-sand end and sandy soil at the high-sand end; then place silty soil before loamy soil.

14. Which of the following soil horizon of a typical soil profile will have the highest abudance of organic matter? [5 marks]

(A) C horizon

(B) A horizon

(C) B horizon

(D) R horizon

Correct Answer: (B) A horizon

Solution:

Concept:

- A soil profile is a vertical sequence of horizons. The surface mineral horizon, A, receives decomposing litter and contains humus mixed with mineral particles.
- Organic matter generally decreases down the mineral soil profile because plant litter enters at the surface and most roots and decomposer activity are concentrated near it.

Step 1: Locate the organic-rich mineral horizon The A horizon is topsoil. Leaves, dead roots and other biological remains are decomposed near the soil surface, and the resulting humus becomes mixed with mineral particles. This mixture commonly gives topsoil its darker colour and supports abundant soil organisms. Thus, among the four horizons listed, A is the one expected to have the highest abundance of organic matter.

Step 2: Distinguish the deeper horizons The B horizon is subsoil, where materials leached from upper horizons may accumulate. It usually contains less humus than topsoil. The C horizon consists mainly of partly weathered parent material and has still less biological enrichment. The R horizon is consolidated bedrock, rather than a humus-rich soil layer. These distinctions exclude the C, B and R horizons offered in options (A), (C) and (D).

Step 3: Apply the qualification in the options Some complete soil profiles also include an O horizon, made largely of surface organic litter. The O horizon is not one of the choices here. Its possible presence does not change the comparison among the horizons actually listed: the A horizon is the organic-rich topsoil and exceeds the deeper B, C and R horizons. Therefore choose the option naming A, rather than confusing the option letter with the horizon letter.

Step 4: Conclusion Among the listed horizons, the A horizon has the highest abundance of organic matter. Hence, the correct option is (B).

Quick Tip to Solve: Remember the profile downward as organic-rich topsoil A, subsoil B, parent material C and bedrock R; compare only the horizons offered.

15. Which of the following can directly cause eutrophication in lakes? A. Sewage waste B. Acidic precipitation C. Agriculture runoff D. Sulfur rich effluent from thermal power plant E. Municipal waste water Choose the correct answer from the options given below: [5 marks]

(A) A, C and D only

(B) B, D and E only

(C) B, C and D only

(D) A, C and E only

Correct Answer: (D) A, C and E only

Solution:

Concept:

- Eutrophication is nutrient enrichment of a water body, especially by compounds supplying nitrogen and phosphorus. Excess nutrients promote algal and aquatic-plant growth.
- When the excess biomass dies, microbial decomposition consumes dissolved oxygen. Nutrient inputs therefore connect excessive growth with oxygen depletion and deterioration of lake ecosystems.

Step 1: Select the sources supplying nutrients Sewage waste, statement A, contains human wastes and other materials that supply nitrogen and phosphorus to receiving water. Agricultural runoff, statement C, can carry nitrate and phosphate fertilisers and animal wastes into lakes. Municipal wastewater, statement E, can likewise carry sewage, nutrient-containing domestic wastes and detergents. All three are direct routes by which nutrient enrichment can stimulate excessive algal growth.

Step 2: Separate nutrient enrichment from other pollution Acidic precipitation, statement B, is principally associated with acidification and changes in water chemistry; acidity itself is not the nitrogen-and-phosphorus enrichment defining eutrophication. Similarly, the specified sulfur-rich thermal-power effluent, statement D, points to sulfur pollution rather than a direct supply of the principal algal nutrients. A discharge can harm a lake without being the direct cause of eutrophication described here.

Step 3: Match the selected statements to an option The selected set is A, C and E only, which appears in option (D). Option (A) incorrectly includes D while omitting E. Option (B) includes both B and D and leaves out the nutrient source C. Option (C) includes B and D while omitting sewage and municipal wastewater. Distinguishing the mechanism of pollution is essential: the question asks specifically about eutrophication, not every possible form of damage to water.

Step 4: Conclusion Sewage waste, agricultural runoff and municipal wastewater can directly cause eutrophication: A, C and E only. Hence, the correct option is (D).

Quick Tip to Solve: For eutrophication, trace sources of nitrogen and phosphorus; do not select a pollutant merely because it can damage aquatic life.

16. Choose the correct statement about water pollution? A. Dissolved oxygen is inversely proportional to BOD in waste water. B. Dissolved ion increases turbidity of water. C. Turbidity is a measure of transparency of water. D. Alkalinity is caused by carbonate, bicarbonate and hydroxides. E. Alkalinity is base neutralising capacity of water. Choose the correct answer from the options given below: [5 marks]

(A) A, B, C and D Only

(B) A, B, C and E Only

(C) A, C and D Only

(D) A, C, D and E Only

Correct Answer: (C) A, C and D Only

Solution:

Concept:

- Biochemical oxygen demand (BOD) expresses the oxygen required by microorganisms to decompose biodegradable organic matter under specified conditions. High BOD tends to deplete dissolved oxygen.
- Turbidity describes the reduction in water clarity caused mainly by suspended and colloidal material. Alkalinity is the acid-neutralising capacity associated chiefly with bicarbonate, carbonate and hydroxide ions.

Step 1: Check oxygen demand and clarity Statement A is accepted: as biodegradable pollution and BOD increase, microbial oxygen consumption generally lowers dissolved oxygen. This is an inverse environmental relationship rather than an exact reciprocal equation under every condition. Statement B is incorrect because dissolved ions normally remain in true solution and do not themselves produce the light scattering characteristic of turbidity. Suspended particles and colloids are the usual direct contributors to turbidity.

Step 2: Check the meaning of turbidity and alkalinity Statement C is accepted in the question's usage: turbidity indicates water transparency or clarity, with greater turbidity meaning lower transparency. Statement D is correct because carbonate, bicarbonate and hydroxide species can neutralise added acid and are major contributors to alkalinity. Statement E is incorrect: alkalinity is acid-neutralising capacity, not base-neutralising capacity. The ability to neutralise added base is associated with acidity.

Step 3: Choose the combination containing only correct statements The correct statements are A, C and D. Option (C) lists exactly those three. Options (A) and (B) both include the incorrect claim B about dissolved ions and turbidity; option (B) also includes E. Option (D) contains E, so it cannot be selected even though it retains A, C and D. Checking the word acid versus base is decisive because reversing that word reverses the definition of alkalinity.

Step 4: Conclusion Statements A, C and D only are correct. Alkalinity neutralises acid, while turbidity primarily reflects suspended material. Hence, the correct option is (C).

Quick Tip to Solve: Link high BOD with low dissolved oxygen, and remember that alkalinity neutralises acid; dissolved salts need not make water turbid.

17. Which of the following is NOT an air pollution control measure/ technique? [5 marks]

(A) Bag houses

(B) Electrostatic Precipitators

(C) High Volume Air Sampler

(D) Cyclone Chambers

Correct Answer: (C) High Volume Air Sampler

Solution:

Concept:

- Air-pollution control devices remove pollutants from a gas stream before it is discharged into the atmosphere.
- An air sampler measures particulate pollution by collecting a known volume of ambient air; measurement is different from emission control.

Step 1: Classify the sampler A High Volume Air Sampler draws ambient air through a collecting filter at a measured high flow rate. The particulate matter retained on the filter is weighed, and the air volume sampled allows its concentration to be calculated. Its purpose is to determine air quality and provide monitoring data. It is not installed to clean the entire stream of industrial exhaust before release.

Step 2: Check the actual removal devices Bag houses pass dusty gas through fabric filters, which retain particulate matter. Electrostatic precipitators charge suspended particles and collect them on oppositely charged plates. Cyclone chambers make the gas rotate, so particles move towards the wall through inertial effects and are separated from the outgoing gas. Thus A, B and D all describe particulate-control techniques, while C describes an instrument for sampling and measurement.

Step 3: Conclusion The High Volume Air Sampler is a monitoring instrument rather than an air-pollution control device. Hence, the correct option is (C).

Quick Tip to Solve: Ask whether the instrument removes pollutants from emissions or merely collects a sample to measure their concentration.

18. Arrange the following steps involved in the sewage treatment in correct order from initial to the last. A. Coagulation and Flocculation B. Chemical disinfection C. Screening D. Distribution of treated water E. Sediment and filtration Choose the correct answer from the options given below: [5 marks]

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

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

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

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

Correct Answer: (C) C, E, A, B, D

Solution:

Concept:

- Screening is a preliminary physical operation that removes large floating and suspended objects before subsequent wastewater-treatment stages.
- Chemical disinfection reduces pathogens after the main impurity-removal operations; distribution or reuse follows treatment.

Step 1: Fix the first and last operations Screening, C, must be the first listed operation: large debris should be removed before the wastewater passes through the treatment equipment. Distribution of treated water, D, must be last because water should not be distributed before treatment and disinfection have been completed. These two boundary conditions immediately reject option A, which places E before screening.

Step 2: Compare the middle stages in the offered sequences For the sequence represented by the choices, E denotes the initial physical removal of sediment and suspended impurities, followed by chemical clarification through coagulation and flocculation, A. Chemical disinfection, B, then precedes distribution. Option B places disinfection before coagulation, leaving a treatment operation after the final pathogen-control stage. Option D similarly places disinfection before sediment removal and filtration. Option C is the offered sequence that retains screening first, the listed impurity-removal operations before disinfection, and distribution last. In a detailed treatment plant, coagulation and flocculation are normally followed by a further settling or filtration stage to remove the flocs; the compressed list should not be read as denying that operation.

Step 3: Conclusion The intended sequence among the given choices is $C \to E \to A \to B \to D$. Hence, the correct option is (C).

Quick Tip to Solve: First anchor screening at the beginning and distribution at the end; then check that disinfection follows the listed removal stages.

19. Gandhiji's concept of development is Sarvodaya which can be achieved through _____ [5 marks]

(A) Navodaya

(B) Suryaodaya

(C) Antyodaya

(D) Sampuranodaya

Correct Answer: (C) Antyodaya

Solution:

Concept:

- Sarvodaya means the welfare or uplift of all, so development must benefit the entire community rather than only privileged groups.
- Antyodaya means the uplift of the last person: giving priority to those who are poorest, weakest or most disadvantaged.

Step 1: Connect the universal goal to the starting point Gandhian development treats human welfare and social justice as central purposes of economic activity. If the least advantaged people remain excluded, an improvement in average income or the prosperity of a small group cannot amount to the welfare of all. Beginning with the needs of the last person therefore provides the practical route towards the wider goal of Sarvodaya.

Step 2: Identify the matching term Antyodaya directly expresses this priority for the last and most disadvantaged person. Its connection to Sarvodaya is conceptual: uplift from the bottom makes inclusive welfare possible. Navodaya refers to a new dawn or awakening, while Suryodaya refers to sunrise; neither names this principle of prioritising the least advantaged. Sampuranodaya is also not the recognised term for the route asked about. The answer should therefore be based on the established meaning of Antyodaya rather than on the similarity of the option endings.

Step 3: Conclusion Sarvodaya, the welfare of all, is pursued through Antyodaya, the uplift of the last and least advantaged person. Hence, the correct option is (C).

Quick Tip to Solve: Remember the link: Sarvodaya is welfare of all; Antyodaya begins with the person who has been left last.

20. Which of the following is not considered as a typical case of migration? [5 marks]

(A) Forceful migration due to terrorism.

(B) Nomadic movements without any intent.

(C) Migration to urban areas for search of jobs.

(D) Voluntary migration within one's region or country.

Correct Answer: (B) Nomadic movements without any intent.

Solution:

Concept:

- Migration ordinarily involves a change in a person's usual place of residence, whether within a country or across a national boundary.
- Migration may be forced or voluntary. Routine or wandering movement without an intention to establish a new usual residence is distinguished from a typical migration event.

Step 1: Apply the residence criterion The key distinction is not whether movement occurs, but whether it amounts to a change of usual residence. The option describes nomadic movements specifically as being without any intent. Such wandering or recurring mobility is not the typical residence-changing event intended by the question. This does not mean that every movement made by a nomadic population is excluded from all definitions of migration; the wording of the option supplies the qualification.

Step 2: Test the remaining examples A person displaced by terrorism may have to leave home and live elsewhere; that is forced migration. Movement to an urban area in search of employment is a common form of economic migration. A voluntary move within a region or country also counts when it changes the usual residence: crossing an international border is not required. Thus A, C and D all describe recognised migration situations, while B is the exception in the question's stated sense.

Step 3: Conclusion Nomadic movements without any intent are not considered a typical case of migration in the sense used here. Hence, the correct option is (B).

Quick Tip to Solve: Use change of usual residence as the test; forced movement and movement within a country can both qualify as migration.

21. Which of the following species is also called as the "Terror of Bengal"? [5 marks]

(A) Clarias gariepinus

(B) Tectona grandis

(C) Eichhornia crassipes

(D) Tamarix dioica

Correct Answer: (C) Eichhornia crassipes

Solution:

Concept:

- An invasive alien species spreads rapidly outside its native range and can displace native organisms or disrupt ecosystem functioning.
- Water hyacinth, *Eichhornia crassipes*, is a free-floating aquatic plant associated with dense mats on freshwater surfaces.

Step 1: Identify the named invasive plant The name "Terror of Bengal" refers to water hyacinth. Its rapid vegetative multiplication enables it to cover ponds and other still-water bodies. The floating mats obstruct light reaching submerged plants and hinder normal use of the water body; decomposition of the accumulated biomass can also increase oxygen demand.

Step 2: Eliminate the other species *Clarias gariepinus* is the African catfish, an invasive fish rather than water hyacinth. *Tectona grandis* is teak, a terrestrial timber tree. *Tamarix dioica* is a shrub or small tree and is not the aquatic weed denoted by this nickname. Thus the ecological identity and the common epithet both identify the third species.

Step 3: Conclusion *Eichhornia crassipes*, or water hyacinth, is called the "Terror of Bengal". Hence, the correct option is (C).

Quick Tip to Solve: Associate "Terror of Bengal" with floating mats of water hyacinth, not the invasive African catfish.

22. Which of the following process of safe disposal of waste will require least amount of energy input? [5 marks]

(A) Incineration

(B) Pyrolysis

(C) Composting

(D) Plasma Arc

Correct Answer: (C) Composting

Solution:

Concept:

- Composting is the controlled biological decomposition of biodegradable organic waste in the presence of oxygen.
- Thermal waste-treatment methods require high temperatures, whereas composting relies mainly

on microbial metabolism and the heat it releases.

Step 1: Compare the treatment mechanisms During composting, microorganisms convert suitable organic waste into a stabilised compost. Moisture, air and a suitable carbon-to-nitrogen balance support decomposition. Turning or aeration may consume some energy, but no furnace or plasma-generating equipment is required; microbial respiration supplies much of the process heat.

Step 2: Exclude the thermal alternatives Incineration burns waste at high temperature and can need auxiliary fuel, especially for wet or low-calorific waste. Pyrolysis thermally decomposes waste with little or no oxygen and requires heat input. Plasma-arc treatment uses an electrically generated, extremely hot plasma, making its energy demand high. Among these four processes, composting therefore has the lowest external energy requirement for suitable biodegradable waste.

Step 3: Conclusion Composting requires the least energy input among the listed processes. Hence, the correct option is (C).

Quick Tip to Solve: For energy comparisons, distinguish microbial decomposition from processes that must generate high temperatures.

23. Choose the correct statements about natural and organic farming A. Natural farming is an example of closed system of farming B. No human supplied artificial inputs are used in natural farming C. Traditional farming promotes polyculture D. Organic farming combines scientific knowledge with traditional farming practices E. Organic farming relies on growing multiple crops on same space Choose the correct answer from the options given below: [5 marks]

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

(B) B, C, D and E only

(C) A, B, C and E only

(D) A, B, D and E only

Correct Answer: (A) A, B, C, D and E

Solution:

Concept:

- Natural farming emphasises ecological self-regulation, recycling within the farm and avoiding synthetic agricultural inputs.
- Polyculture means growing more than one crop in the same area; it is a familiar feature of traditional diversified farming and is also used in organic farming.

Step 1: Evaluate the five statements A is correct in the intended farm-system sense: natural farming seeks a closed nutrient cycle through recycling local biomass rather than dependence on purchased synthetic inputs. B is correct because artificial fertilisers and synthetic pesticides are avoided. C is also correct: traditional mixed cropping and intercropping promote polyculture, unlike the specialised monocultures associated with intensive modern production.

Step 2: Check organic farming and the offered combinations D is correct because organic farming combines traditional practices such as manure use and crop rotation with scientific understanding of

soils, nutrient cycling and pest management. E describes its use of crop diversity and multiple-crop systems to improve resource use and ecological stability. All five statements are therefore accepted as descriptions in this question. Every shorter combination omits a correct statement: the second omits A, the third omits D and the fourth omits C. In particular, there is no valid basis for rejecting traditional farming's promotion of polyculture.

Step 3: Conclusion A, B, C, D and E are correct in the intended description. Hence, the correct option is (A). The supplied key selects the combination excluding C, but traditional mixed cropping and intercropping are polycultures, so the printed statement C is true.

Quick Tip to Solve: Test each statement independently; traditional mixed cropping is direct evidence that traditional farming promotes polyculture.

24. Which of the following does not apply to High Yielding Varieties (HYVs) of crops? [5 marks]

(A) They are semi-dwarf and are protected from strong winds.

(B) They mature early and save time for raising other crops in same field.

(C) They are disease resistant and does not require pesticides.

(D) They require better input like water and fertilisers.

Correct Answer: (C) They are disease resistant and does not require pesticides.

Solution:

Concept:

- High yielding varieties express their high production potential under favourable management, including adequate irrigation and fertiliser supply.
- Resistance is specific to particular pests or diseases; being high yielding does not guarantee universal disease resistance or eliminate all need for plant protection.

Step 1: Identify normal HYV characteristics Semi-dwarf cereal varieties have shorter, sturdier stems and are less prone to lodging under wind or heavy grain loads. Early maturation permits more than one crop in the same field during a year. These explain why the first two descriptions are associated with the development and use of HYVs.

Step 2: Find the statement that overgeneralises HYVs usually need dependable water, nutrients and suitable management to realise their yield potential, so the fourth statement applies. The third statement goes too far: an HYV may resist selected diseases, but this does not make it immune to every disease or pest. Pesticide need depends on the actual threat and management strategy. Therefore the claim that HYVs do not require pesticides cannot be treated as a general property of these crops.

Step 3: Conclusion The claim that HYVs are disease resistant and do not require pesticides does not generally apply. Hence, the correct option is (C).

Quick Tip to Solve: For "does not apply" questions, check absolute claims: high yield does not mean immunity to every pest and disease.

25. Match List-I with List-II.

List-I (Water harvesting method)	List-II (State/UT in which its popularly used)
(A) Nadis	(I) Jammu and Kashmir
(B) Bandiharas	(II) Rajasthan
(C) Ponds	(III) Maharashtra
(D) Eris	(IV) Tamil Nadu

Choose the correct answer from the options given below: [5 marks]

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

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

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

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

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

Solution:

Concept:

- Traditional water-harvesting systems collect and store local runoff, and their names are associated with particular regions of India.
- For a matching question, establish the known method-state pairs first and then check that every pair appears in the chosen option.

Step 1: Identify the regional systems Nadis are traditional village ponds used to store runoff in Rajasthan, especially in its dry regions. Thus A matches II. Bandiharas are traditional diversion or check-dam systems associated with Maharashtra, so B matches III. These systems conserve seasonal flow for subsequent use rather than allowing all runoff to escape.

Step 2: Complete and test the matching Eris are the traditional tank systems of Tamil Nadu, giving D-IV. In the list supplied, ponds are paired with Jammu and Kashmir, giving C-I. Ponds are not exclusive to this region, but this is the specified regional association in the matching set. The complete sequence is therefore A-II, B-III, C-I, D-IV. Option A incorrectly places Nadis in Jammu and Kashmir and Bandiharas in Rajasthan. Option C also misplaces Nadis and pairs ponds with Rajasthan. Option D places Nadis in Tamil Nadu and Eris in Rajasthan, reversing their familiar regional associations.

Step 3: Conclusion The matching is A-II, B-III, C-I, D-IV: Nadis-Rajasthan, Bandiharas-Maharashtra, ponds-Jammu and Kashmir, and Eris-Tamil Nadu. Hence, the correct option is (B).

Quick Tip to Solve: Use Nadis-Rajasthan and Eris-Tamil Nadu as anchor pairs, then verify the remaining two matches rather than guessing from one pair.

26. Which of the following is NOT true for mixed farming? [5 marks]

(A) It helps in maintaining soil fertility.

(B) It reduces soil erosion.

(C) It improves production level and give higher production than monoculture.

(D) It provides suitable habitat for birds.

Correct Answer: (C) It improves production level and give higher production than monoculture.

Solution:

Concept:

- Mixed farming combines crop cultivation with animal husbandry, so that crop residues can feed animals and animal manure can replenish soil organic matter.
- Total farm output is different from the yield of a particular crop. Diversifying farm activities does not establish that production must exceed monoculture.

Step 1: Identify the accepted environmental benefits Returning livestock manure to the fields adds organic matter and nutrients, helping to maintain soil fertility, so A describes a benefit. Appropriate crop cover and varied farm management can reduce exposed soil and soil erosion, supporting B. A diversified agricultural landscape can also provide feeding and shelter opportunities for birds, which is the ecological benefit stated in D. These statements concern the resource recycling, soil protection and habitat value associated with mixed farming.

Step 2: Examine the production comparison Statement C makes the broader claim that mixed farming gives higher production than monoculture. That comparison is not generally valid: production depends on the crop or livestock enterprise, the land allocation, management, inputs and the units in which output is compared. A specialised monoculture may give a higher yield of its particular crop, whereas a mixed farm spreads land and labour across crops and livestock. Mixed farming can improve resource use, diversify income and reduce dependence on a single enterprise, but these benefits do not prove a general superiority in production over monoculture. Therefore the higher-production claim is the statement that is not true as a general characteristic of mixed farming.

Step 3: Conclusion The claim that mixed farming gives higher production than monoculture is not a generally valid characteristic of the system. Hence, the correct option is (C).

Quick Tip to Solve: Distinguish better resource recycling and diversified income from a universal claim of higher production; a production comparison needs a specified output and conditions.

27. The measure of number of different food groups consumed over a specific reference period (24 hr/ 8hr/ 7 days) is known as _____. [5 marks]

(A) Household food insecurity scale

(B) Household dietary diversity scale

(C) Household hunger scale

(D) Coping strategies index

Correct Answer: (B) Household dietary diversity scale

Solution:

Concept:

- Dietary diversity describes the variety of food groups consumed during a stated reference period.
- A dietary diversity measure counts food-group variety; hunger, food insecurity and coping measures assess different dimensions of inadequate food access.

Step 1: Identify the measured quantity The question specifically asks for the number of different food groups consumed over a reference period. Each distinct food group represented in the household diet contributes to the measure. Counting variety is different from counting meals, measuring the weight of food eaten, or measuring the energy supplied. The reference period specifies when consumption is recalled; it does not change the fact that food-group variety is being measured.

Step 2: Distinguish the four indicators The household dietary diversity scale measures the range of food groups consumed, so it directly fits the definition. A household food insecurity scale assesses experiences related to inadequate access to food rather than simply enumerating food groups. A household hunger scale focuses on hunger and severe deprivation. A coping strategies index records behaviours households use when obtaining enough food becomes difficult, such as reducing portions or relying on less-preferred foods. None of those three alternatives is defined as the number of different food groups consumed. The deciding phrase is therefore different food groups, rather than the length of the recall period.

Step 3: Conclusion The measure described is the household dietary diversity scale, which records the variety of food groups consumed over the reference period. Hence, the correct option is (B).

Quick Tip to Solve: Link diversity with variety of food groups; link hunger with deprivation and coping with behaviours used to manage food shortages.

28. Which of the following is an example of Kharif Crop? [5 marks]

(A) Wheat

(B) Gram

(C) Paddy

(D) Mustard

Correct Answer: (C) Paddy

Solution:

Concept:

- Kharif crops are generally sown with the onset of the southwest monsoon and harvested after the rainy growing season.
- Rabi crops are generally sown in the cooler winter season and harvested in spring; classify the named crop by its usual Indian cropping season.

Step 1: Classify paddy by its growing conditions Paddy is the principal Kharif crop among the choices. Its usual main-season cultivation coincides with the warm, wet monsoon months. Rainfall and irrigation provide the water needed for crop establishment and growth. Although rice may be grown in other seasons in suitable irrigated regions, that regional variation does not alter its standard classification as a Kharif crop in this question.

Step 2: Eliminate the Rabi alternatives Wheat is typically sown after the monsoon in the cool season and harvested in spring, so it is a Rabi crop. Gram is also normally a Rabi pulse, grown in the winter cropping season rather than as the usual monsoon example. Mustard is a Rabi oilseed crop that favours the cooler season. Thus options A, B and D all belong to the contrasting seasonal group. Paddy alone supplies the standard Kharif example among these four choices. The classification is based on the usual sowing and growing season, not on whether the crop is a cereal, pulse or oilseed.

Step 3: Conclusion Paddy is the Kharif crop; wheat, gram and mustard are normally Rabi crops. Hence, the correct option is (C).

Quick Tip to Solve: Remember paddy with the rainy Kharif season; wheat, gram and mustard form a useful group of common winter Rabi crops.

29. Which of the following state in India first adopted Green Revolution ? [5 marks]

(A) Haryana

(B) Punjab

(C) Uttar Pradesh

(D) Madhya Pradesh

Correct Answer: (B) Punjab

Solution:

Concept:

- The Green Revolution introduced high-yielding crop varieties together with assured irrigation, fertilisers and improved agricultural practices to increase foodgrain production.
- Punjab was the pioneering Indian state associated with the early adoption and success of this package, particularly for wheat.

Step 1: Identify the pioneering agricultural region The question asks about the first adopter of the Green Revolution, rather than the state with the greatest area or the largest total population. Punjab became the principal early centre of the high-yielding wheat programme. Its irrigated agriculture, use of fertilisers, farm mechanisation and access to the new varieties allowed the combined package to raise yields substantially. The relevant historical association is therefore Punjab.

Step 2: Compare all four states Haryana also became an important beneficiary of the Green Revolution and shares many of the agricultural conditions of Punjab, but it is not the pioneering state intended by this question. Uttar Pradesh adopted the new agricultural methods too, especially in its western irrigated districts; participation in the programme does not make it the first adopter. Madhya Pradesh is an important wheat-producing state, but its later agricultural expansion is not the initial Green Revolution centre asked for here. Thus Punjab, rather than the other three states, supplies the required historical identification.

Step 3: Conclusion Punjab first adopted the Green Revolution among the listed states. Hence, the correct option is (B).

Quick Tip to Solve: For the initial Indian Green Revolution, associate high-yielding wheat and assured irrigation with Punjab; distinguish early adoption from later production rankings.

30. Match List-I with List-II.

List-I (Ecosystem services)	List-II (explanation or example)
(A) Provisioning Services	(I) All services which are neccessary for production of all ecosystem services.
(B) Regulating Services	(II) Ecosystem is a store house of formal and informal education.
(C) Cultural Services	(III) Soil erosion is reduced by plants by binding soil particles.
(D) Supporting Services	(IV) Genetic resources including crop improvement and health care.

Choose the correct answer from the options given below: [5 marks]

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

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

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

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

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

Solution:

Concept:

- Ecosystem services include provisioning benefits, regulation of natural processes, cultural benefits and the supporting processes that make other services possible.
- Classify each example by the benefit it supplies: a usable resource, environmental regulation, education or the foundation of other services.

Step 1: Match provisioning and regulating services Provisioning services supply useful biological materials and resources. Genetic resources used in crop improvement and health care are therefore provisioning benefits, giving A–IV. Regulating services moderate environmental conditions and processes. Plant roots bind soil particles and vegetation reduces erosion, so the reduction of soil erosion belongs to regulating services: B–III. This is an environmental protection function, rather than an educational benefit or the supply of a genetic resource.

Step 2: Match cultural and supporting services Cultural services provide non-material benefits, including learning, recreation and aesthetic appreciation. An ecosystem acting as a storehouse of formal and informal education is therefore a cultural service, giving C–II. Supporting services underpin the production of other ecosystem services, exactly as description I states, so D–I. The complete combination is A–IV, B–III, C–II, D–I. Option (A) wrongly assigns education to provisioning and genetic resources to cultural services. Option (C) puts erosion control under provisioning and education under regulation. Option (D) exchanges the supporting and regulating descriptions. Only option (B) preserves all four categories.

Step 3: Conclusion The matching is A–IV, B–III, C–II, D–I. Hence, the correct option is (B).

Quick Tip to Solve: Use four anchors: resources are provisioning, process control is regulating, education is cultural, and the foundation of other services is supporting.

31. Resources that have been surveyed but cannot used by humans due to lack of technology are known as _____ [5 marks]

(A) Potential resources

(B) Actual resources

(C) Reserve resources

(D) Stock resources

Correct Answer: (D) Stock resources

Solution:

Concept:

- Stock resources are materials that could satisfy human needs but cannot currently be used because the required technology is unavailable.
- Reserves can be used with existing technology but are conserved for future use; technological inability is different from deliberate non-use.

Step 1: Locate the decisive condition The resources in the question have been surveyed, so their existence is known. However, humans cannot use them because they lack suitable technology. The reason for non-use, rather than the mere fact that the resources are known, decides their category. Materials with useful potential but without an available means of extraction, conversion or effective utilisation belong to stock resources. Their usefulness cannot yet be realised through the technology at hand.

Step 2: Distinguish stock from the other categories Potential resources are known to occur in a region but have not yet been fully developed or utilised; that description does not specifically establish a technological barrier. Actual resources have been surveyed and their quantity and quality determined for present use, so the inability to use the material rules out option (B). Reserve resources are usable with current technology but are kept for future needs; they are not inaccessible because the necessary technology is missing. Consequently, surveyed resources that remain unusable for the stated technological reason are stock resources, making option (D) the precise choice rather than (A), (B) or (C).

Step 3: Conclusion These are stock resources because the technology required to use them is lacking. Hence, the correct option is (D).

Quick Tip to Solve: Ask why a known resource is unused: missing technology indicates stock; usable now but saved for later indicates a reserve.

32. Match List-I with List-II.

List-I (Type of externality)	List-II (Example)
(A) Negative production externality	(I) A good attractive house increases value of that area.
(B) Negative consumption externality	(II) Development of an airport will benefit trade and business due to increased accessibility.
(C) Positive production externality	(III) Increased risk of accidents due to many vehicles.
(D) Positive consumption externality	(IV) Industrial effluents contaminating rivers and streams.

Choose the correct answer from the options given below: [5 marks]

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

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

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

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

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

Solution:

Concept:

- An externality is an effect of production or consumption on third parties that is not fully reflected in the market transaction.
- Classify the originating activity as production or consumption, then classify its spillover as a benefit (positive) or a cost (negative).

Step 1: Match the harmful spillovers Industrial effluents contaminating rivers and streams arise from production and impose pollution costs on other people and ecosystems. This is a negative production externality, so A–IV. Many vehicles increasing accident risks impose harmful spillovers associated with the use of transport. In the listed classification, this is the negative consumption externality, so B–III. The distinction is between industrial discharge generated by producing goods and the additional risk generated when transport is used.

Step 2: Match the beneficial spillovers and eliminate alternatives Developing an airport improves accessibility and benefits surrounding trade and business beyond the direct airport transaction. This beneficial effect of providing infrastructure is the positive production externality: C–II. An attractive house can raise the value or amenity of the surrounding area, conferring benefits on neighbours; this is the listed positive consumption externality, giving D–I. Thus the complete match is A–IV, B–III, C–II, D–I. Option (A) wrongly assigns accident risk to production and pollution to the positive category. Option (C) swaps the two negative examples. Option (D) treats the attractive-house benefit as negative and the pollution cost as positive. Only option (B) has the correct origin and sign for every example.

Step 3: Conclusion The matching is A–IV, B–III, C–II, D–I. Hence, the correct option is (B).

Quick Tip to Solve: For externalities, make two separate decisions: identify the activity creating the effect, then decide whether outsiders receive a benefit or bear a cost.

33. Which of the following is the correct relationship between Gross Domestic product (GDP), Gross National Product (GNP), Net Income Receipt (X), and Net Outflow to the foreign Assets (Y)? [5 marks]

(A) GNP = GDP - X + Y

(B) GNP = GDP + X - Y

(C) GDP - X = GNP + Y

(D) GDP + Y = GNP - X

Correct Answer: (B) GNP = GDP + X - Y

Solution:

Concept:

- Gross domestic product measures production within a country, while gross national product attributes production income to its residents.
- To move from domestic to national product, add income received from abroad and subtract income paid to foreign factors. These adjustments must have opposite signs.

Step 1: Identify the direction of each flow The receipt X adds income attributable to the nation that is not included in its domestic production. It therefore enters with a positive sign. The outward income flow Y belongs to foreign factors rather than resident factors and therefore enters with a negative sign.

Step 2: Apply the domestic-to-national adjustment The required relationship is

$$\text{GNP} = \text{GDP} + X - Y.$$

Option (A) reverses both adjustments. Option (C) rearranges to GNP = GDP - X - Y and incorrectly subtracts receipts. Option (D) rearranges to GNP = GDP + X + Y and incorrectly adds the outward flow.

Step 3: Conclusion GNP equals GDP plus receipts from abroad less the outward flow: $\text{GNP} = \text{GDP} + X - Y$. Hence, the correct option is (B).

Quick Tip to Solve: For a domestic-to-national conversion, put a plus sign on income coming in and a minus sign on income going out.

34. Ecological Foot Print (EFP) does not measure- [5 marks]

(A) Amount of waste generated by human population

(B) Consumption of natural resources by human population

(C) Income generated by human population

(D) Demand of human from ecosystems

Correct Answer: (C) Income generated by human population

Solution:

Concept:

- An ecological footprint expresses human demand on biologically productive land and water needed to supply resources and absorb relevant wastes.

- It is an environmental demand indicator, expressed as productive area, rather than a measure of monetary earnings.

Step 1: Identify what the footprint represents Resource consumption requires cropland, grazing land, fishing grounds and forest products. Waste assimilation also places demands on ecosystems; the carbon component estimates the forest area required to absorb carbon dioxide emissions. Thus resource use, waste-related demand and overall ecosystem demand fall within the footprint concept.

Step 2: Separate monetary income from ecological demand Income generated is a monetary economic quantity. Although higher income can influence consumption patterns and hence affect a footprint indirectly, the footprint does not measure income itself. Options (A), (B) and (D) describe environmental pressures considered in footprint accounting, whereas option (C) describes a financial outcome.

Step 3: Conclusion Income generated by the human population is not measured by the ecological footprint. Hence, the correct option is (C).

Quick Tip to Solve: Ask whether the indicator measures productive area demanded from nature or money earned: the ecological footprint measures the former.

35. Agreement between two or more nations to reduce or eliminate tariff and non-tariff barrier on trade is known as:- [5 marks]

(A) Free trade agreements

(B) Foreign trade agreements

(C) Free tariff treaty

(D) Custom trade agreements

Correct Answer: (A) Free trade agreements

Solution:

Concept:

- A tariff is a tax on traded goods, while a non-tariff barrier restricts trade through measures other than such taxes.
- A free trade agreement is an arrangement among participating nations to reduce or remove barriers to trade between them.

Step 1: Match the definition to its purpose The question describes a negotiated reduction or elimination of both tariff and non-tariff barriers among two or more nations. Its central purpose is to make trade between participating countries freer. This is the defining purpose of a free trade agreement; it need not mean that every restriction disappears immediately.

Step 2: Distinguish the alternative terms Option (A) gives the standard name for this arrangement. Foreign trade agreements in option (B) is a broad expression that does not specifically identify barrier removal. Free tariff treaty in option (C) is not the standard term and overlooks non-tariff barriers. Custom trade agreements in option (D) is also not the accepted name for the stated definition.

Step 3: Conclusion The arrangement is a free trade agreement. Hence, the correct option is (A).

Quick Tip to Solve: When a definition stresses reducing tariffs and other trade barriers between signatories, identify a free trade agreement.

36. An international effort "REDD+" was proposed in the year 2005 by developing countries for . [5 marks]

(A) Reducing CFCs emissions for recovery of ozone layer

(B) Reducing deforestation to combat global warming

(C) Conserving wetlands for water management

(D) Conserving fossil fuel for next generation

Correct Answer: (B) Reducing deforestation to combat global warming

Solution:

Concept:

- REDD refers to reducing emissions from deforestation and forest degradation in developing countries.
- Forests store carbon in vegetation and soils. Their removal releases stored carbon and reduces future carbon uptake; protecting them supports climate mitigation.

Step 1: Connect the initiative to forest carbon The initiative addresses the climate impact of losing and degrading forests. Avoiding deforestation prevents emissions associated with clearing forest biomass and helps retain a carbon sink. REDD+ also includes conservation, sustainable management of forests and enhancement of forest carbon stocks.

Step 2: Compare the environmental objectives Reducing deforestation to combat global warming in option (B) directly matches this forest-carbon objective. Option (A) concerns ozone-depleting substances, addressed through the Montreal Protocol framework. Option (C) concerns wetlands and water management rather than the specific REDD+ mechanism. Option (D) concerns preserving fossil fuel resources, not forest-based emissions reductions.

Step 3: Conclusion REDD+ aims to reduce deforestation and associated emissions in order to combat global warming. Hence, the correct option is (B).

Quick Tip to Solve: Read the first letters of REDD as reducing emissions from deforestation and degradation; connect the initiative to forests and carbon.

37. Which of the following are important cycles of catalytic destruction of ozone in stratosphere ? A. CO / CO2 B. HO / HO2 C. NO / NO2 D. Cl / ClO E. SO / SO2 Choose the correct answer from the options given below: [5 marks]

(A) A and D only

(B) B, C and D only

(C) A, C and D only

(D) A, D and E only

Correct Answer: (B) B, C and D only

Solution:

Concept:

- Catalytic ozone destruction involves a reactive species that consumes ozone and is regenerated, allowing repeated destruction rather than a single stoichiometric reaction.
- The important radical families are hydrogen oxides (HO_x), nitrogen oxides (NO_x) and chlorine oxides (ClO_x).

Step 1: Identify the three catalytic families B gives the hydroxyl/hydroperoxyl pair, HO/HO2, conventionally written OH/HO2. These radicals interconvert in ozone-loss chemistry. C gives NO/NO2: nitric oxide reacts with ozone to form nitrogen dioxide, which can react with atomic oxygen to regenerate NO. D gives Cl/ClO, the chlorine radical cycle associated with stratospheric ozone depletion.

Step 2: Check regeneration and eliminate the other pairs A representative chlorine cycle is

$$Cl + O_3 \longrightarrow ClO + O_2$$

followed by

$$ClO + O \longrightarrow Cl + O_2.$$

Chlorine is regenerated and the net effect is $O_3 + O \longrightarrow 2\,O_2$. The nitrogen-oxide cycle has an analogous regeneration step. The HO/HO2 pair also participates in catalytic ozone loss. CO/CO2 and SO/SO2 are not the important stratospheric ozone-destruction radical cycles listed in this classification. Thus A and E must be excluded. Options (A) and (C) contain A, while option (D) contains both A and E; each therefore includes an incorrect pair.

Step 3: Conclusion The important cycles are B, C and D only: HO/HO2, NO/NO2 and Cl/ClO. Hence, the correct option is (B).

Quick Tip to Solve: Look for a radical regenerated at the end of the cycle; remember the HOx, NOx and ClOx families for stratospheric ozone loss.

38. Which of the following gas is both a green house gas and a criteria air pollutants? [5 marks]

(A) Nitrous oxide

(B) Carbon dioxide

(C) Ozone

(D) Sulphur hexafluoride

Correct Answer: (C) Ozone

Solution:

Concept:

- A greenhouse gas absorbs outgoing terrestrial infrared radiation and contributes to warming of the atmosphere.
- A criteria air pollutant is a common air pollutant assessed against ambient air-quality criteria because of its adverse effects on health or the environment. Ozone belongs to both categories.

Step 1: Apply both conditions to ozone Ozone, O_3, absorbs infrared radiation and therefore acts as a greenhouse gas. Near the ground, it is a strong oxidant and a major component of photochemical smog. It irritates the respiratory system and damages vegetation, so ground-level ozone is also a criteria air pollutant. Its protective role in absorbing ultraviolet radiation in the stratosphere does not cancel these other properties: atmospheric location matters.

Step 2: Compare every alternative Nitrous oxide, N_2O, is a greenhouse gas, but it is not the nitrogen-oxide criteria pollutant generally represented by nitrogen dioxide. Carbon dioxide, CO_2, is the best-known anthropogenic greenhouse gas, but it is not a criteria air pollutant in this classification. Do not confuse carbon dioxide with carbon monoxide, which is a criteria pollutant. Sulphur hexafluoride, SF_6, is a very potent greenhouse gas, but it is not a criteria air pollutant either. Only ozone satisfies both requirements simultaneously; merely identifying a greenhouse gas is insufficient because all four choices have a greenhouse role.

Step 3: Conclusion Ozone is both a greenhouse gas and, at ground level, a criteria air pollutant. Hence, the correct option is (C).

Quick Tip to Solve: For a question joining two categories with "both", test each category separately. Distinguish CO2 from CO and N2O from NO2.

39. Arrange the following international events in a chronological order starting from old to recent as per their year of enactment. A. Basel Convention B. Bamako Convention C. Paris Agreement on Climate Change D. Kigali Amendment E. Kyoto Protocol Choose the correct answer from the options given below: [5 marks]

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

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

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

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

Correct Answer: No printed option is correct: consistent adoption and entry-into-force chronology both give A, B, E, C, D; the key selects (C).

Solution:

Concept:

- The adoption of a treaty and its entry into force are distinct events. A chronological comparison must use the same event for every treaty.
- Using adoption years, the sequence is Basel (1989), Bamako (1991), Kyoto (1997), Paris (2015), Kigali (2016).

Step 1: Order the events by adoption The Basel Convention was adopted in 1989. The Bamako Convention was adopted in 1991. The Kyoto Protocol was adopted in 1997. The Paris Agreement was adopted in 2015, followed by the Kigali Amendment in 2016. Therefore the chronological order of adoption or enactment is

$$A,\ B,\ E,\ C,\ D.$$

None of the four printed options contains this sequence.

Step 2: Check whether entry into force resolves the choices Basel entered into force in 1992, Bamako in 1998, Kyoto in 2005, Paris in 2016 and Kigali in 2019. This again gives A, B, E, C, D. Option (A) incorrectly puts Bamako after Paris and Kigali. Option (B) starts with Kigali and reverses much of the chronology. Option (C), A, E, B, C, D, places Kyoto before Bamako. That ordering can be produced only by mixing Kyoto's 1997 adoption with Bamako's 1998 entry into force, rather than using one consistent criterion. Option (D) puts Kyoto before Basel and Bamako. Consequently none is historically correct under a consistent adoption or entry-into-force interpretation. The keyed option (C) should not be presented as an unqualified historical fact.

Step 3: Conclusion No printed option gives the correct chronological sequence A, B, E, C, D. The supplied key identifies (C), but its ordering reverses Bamako (adopted 1991) and Kyoto (adopted 1997); it is not correct under a consistent date criterion.

Quick Tip to Solve: Keep separate columns for adoption and entry into force when ordering treaties. Never mix dates from the two columns to fit an option.

40. Total columnar ozone in the atmosphere is measured in Dobson units. One Dobson unit corresponds to _____

[5 marks]

(A) $\frac{1}{10}$ of mm
(B) $\frac{1}{100}$ of mm
(C) $\frac{1}{1000}$ of mm
(D) $\frac{1}{100}$ of cm

Correct Answer: (B) $\frac{1}{100}$ of mm

Solution:

Concept:

- A Dobson unit expresses the amount of ozone in a vertical atmospheric column as the thickness of pure ozone obtained if it were compressed to standard temperature and pressure.
- One Dobson unit corresponds to an equivalent ozone thickness of $0.01\,\text{mm}$, or $10^{-5}\,\text{m}$, at standard temperature and pressure.

Step 1: Write the defining thickness Total column ozone is the integrated amount of ozone above a unit area, rather than the local concentration at one height. Its equivalent compressed thickness is related to Dobson units by

$$1\,\text{DU} = 0.01\,\text{mm} = \frac{1}{100}\,\text{mm}.$$

Thus the fraction with denominator 100 and unit millimetre is the required expression. For orientation, a column of 300 DU would form a pure-ozone layer 3 mm thick at standard temperature and pressure; it does not imply that atmospheric ozone actually occupies a layer only 3 mm thick.

Step 2: Convert the distractors to millimetres Option (A), one tenth of a millimetre, equals 0.1 mm and represents 10 DU. Option (C), one thousandth of a millimetre, equals 0.001 mm and represents 0.1 DU. Option (D) uses centimetres: since $1\,\text{cm} = 10\,\text{mm}$,

$$\frac{1}{100}\,\text{cm} = 0.1\,\text{mm},$$

so it also represents 10 DU. Options (A) and (D) are equivalent distractors. Only option (B) has the defining thickness of 0.01 mm. Checking both the fraction and the length unit prevents a factor-of-ten error.

Step 3: Conclusion One Dobson unit corresponds to $\frac{1}{100}$ of a millimetre of pure ozone at standard temperature and pressure. Hence, the correct option is (B).

Quick Tip to Solve: Remember 100 DU = 1 mm at standard temperature and pressure; convert every centimetre option to millimetres before comparing.

41. Annual NPP of land area on the earth is _____ [5 marks]

For any ecosystem, a constant input of energy is the basic requirement for its functioning and sustenance. The productivity of an ecosystem is calculated as the rate of biomass production expressed as gram/square meter/year (g. m^{-2}. yr^{-1}). The rate of production of organic matter during photosynthesis is called gross primary productivity (GPP). A considerable portion of GPP is consumed and utilized by plants during respiration. Therefore, the biomass available for heterotrophs is known as net primary productivity (NPP). The rate of formation of new organic matter by consumers is known as secondary productivity (SP).

Primary productivity depends on the plants species inhabiting a particular area, availability of nutrients, photosynthetic capacity of plants, and other environmental factors. The annual NPP of whole biosphere is approximately 170 billion tons, out of which, productivity of oceans is around 55 billions tons. In soil, the dead organic matter is converted to humans through humification. Humus undergoes slow degradation and is a reservoir of soil nutrients. Over a period of time, humus is further degraded by microbes and release nutrients by a process called mineralization.

(A) $<$ 55 billion tons

(B) between 55 to 100 billion tons

(C) About 115 billion tons

(D) 225 billion tons

Correct Answer: (C) About 115 billion tons

Solution:

Concept:

- Net primary productivity (NPP) is the organic matter left after producers have used part of gross primary productivity in respiration. It is available for heterotrophs.
- The annual NPP of the whole biosphere is the sum of terrestrial NPP and oceanic NPP. The passage gives approximately 170 billion tons for the biosphere and 55 billion tons for oceans.

Step 1: Identify the required component The question asks for the annual NPP of land, rather than that of oceans or of the entire biosphere. Use the two quantities in the passage on the same annual basis: both are measured in billion tons per year, so their difference retains that unit. Since land and oceans together make up the biosphere, subtract the ocean contribution from the total; adding the two would count the ocean contribution twice.

Step 2: Subtract and compare the options

$$\text{Land NPP} = 170 - 55 = 115 \text{ billion tons per year.}$$

This is about 115 billion tons, matching option (C). Option (A), less than 55 billion tons, is below even the ocean value; option (B), between 55 and 100 billion tons, does not include 115. Option (D), 225 billion tons, equals an inappropriate addition and exceeds the stated total of 170 billion tons.

Step 3: Conclusion Annual terrestrial NPP is approximately 115 billion tons. Hence, the correct option is (C).

Quick Tip to Solve: For a land-versus-ocean productivity question, write total = land + ocean before inserting the passage values.

42. For any ecosystem, a constant input of energy is the basic requirement for its functioning and sustenance. The productivity of an ecosystem is calculated as the rate of biomass production expressed as gram/square meter/year (g. m^{-2}. yr^{-1}). The rate of production of organic matter during photosynthesis is called gross primary productivity (GPP). A considerable portion of GPP is consumed and utilized by plants during respiration. Therefore, the biomass available for heterotrophs is known as net primary productivity (NPP). The rate of formation of new organic matter by consumers is known as secondary productivity (SP).

Primary productivity depends on the plants species inhabiting a particular area, availability of nutrients, photosynthetic capacity of plants, and other environmental factors. The annual NPP of whole biosphere is approximately 170 billion tons, out of which, productivity of oceans is around 55 billions tons. In soil, the dead organic matter is converted to humus through humification. Humus undergoes slow degradation and is a reservoir of soil nutrients. Over a period of time, humus is further degraded by microbes and release nutrients by a process called mineralization.

Which of the following is not associated with photosynthetic plants? [5 marks]

(A) Net primary productivity

(B) Gross primary productivity

(C) Primary productivity

(D) Secondary productivity

Correct Answer: (D) Secondary productivity

Solution:

Concept:

- Primary productivity is the production of organic matter by autotrophic producers, including photosynthetic plants.
- Gross primary productivity is the total photosynthetic production; net primary productivity is what remains after plant respiration. Secondary productivity is the formation of new organic matter by consumers.

Step 1: Classify the plant-associated quantities Photosynthetic plants capture light energy and form organic matter. Their total rate of production is GPP, so option (B) is associated with them. Plants also respire, and the remaining production is NPP: $\text{NPP} = \text{GPP} - R$, where R is plant respiratory use. Thus option (A) is also associated with plants. Option (C), primary productivity, is the broader producer-level category that includes these measures.

Step 2: Identify the consumer-associated quantity The passage explicitly defines secondary productivity as the rate of formation of new organic matter by consumers. Consumers obtain organic food from other organisms and incorporate part of it into their own biomass. This is a different trophic process from photosynthetic production by plants. Therefore secondary productivity is the only listed category that does not describe photosynthetic plants. The word secondary refers to consumer biomass formation, not to the portion of plant GPP remaining after respiration.

Step 3: Conclusion Secondary productivity is associated with consumers rather than photosynthetic plants. Hence, the correct option is (D).

Quick Tip to Solve: Link primary to producers and secondary to consumers; gross and net both qualify primary production.

43. For any ecosystem, a constant input of energy is the basic requirement for its functioning and sustenance. The productivity of an ecosystem is calculated as the rate of biomass production expressed as gram/square meter/year (g. m^{-2}. yr^{-1}). The rate of production of organic matter during photosynthesis is called gross primary productivity (GPP). A considerable portion of GPP is consumed and utilized by plants during respiration. Therefore, the biomass available for heterotrophs is known as net primary productivity (NPP). The rate of formation of new organic matter by consumers is known as secondary productivity (SP).

Primary productivity depends on the plants species inhabiting a particular area, availability of nutrients, photosynthetic capacity of plants, and other environmental factors. The annual NPP of whole biosphere is approximately 170 billion tons, out of which, productivity of oceans is around 55 billions tons. In soil, the dead organic matter is converted to humus through humification. Humus undergoes slow degradation and is a reservoir of soil nutrients. Over a period of time, humus is further degraded by microbes and release nutrients by a process called mineralization.

Choose the correct statement. [5 marks]

(A) Annual NPP of land area is higher than oceans.

(B) NPP is greater than GPP in terrestrial ecosystems.

(C) Secondary productivity is always higher than Primary productivity in Oceanic ecosystem.

(D) Primary productivity is unaffected by environmental factors.

Correct Answer: (A) Annual NPP of land area is higher than oceans.

Solution:

Concept:

- The passage states that annual biosphere NPP is about 170 billion tons and ocean NPP about 55 billion tons; the land contribution is their difference.
- Net primary productivity is gross primary productivity minus plant respiratory use. Primary productivity depends on plant species, nutrient availability, photosynthetic capacity and environmental conditions.

Step 1: Test the statement about land and oceans Calculate terrestrial annual NPP from the passage:

$$\text{Land NPP} = 170 - 55 = 115 \text{ billion tons.}$$

Since $115 > 55$, land contributes more annual NPP than oceans. This directly supports option (A). Compare the absolute annual production specified here, rather than inferring production merely from the relative areas occupied by land and ocean.

Step 2: Reject the remaining statements Option (B) reverses the relation between net and gross production. Because respiratory use is subtracted, $\text{NPP} = \text{GPP} - R$, NPP cannot exceed GPP when R is positive. Option (C) asserts that oceanic secondary productivity is always higher than primary productivity; consumers depend on organic matter produced at the producer level, and the passage gives no such rule. Option (D) directly contradicts the passage, which names environmental factors and nutrient availability as determinants of primary productivity.

Step 3: Conclusion The correct statement is that annual NPP of land area is higher than that of oceans. Hence, the correct option is (A).

Quick Tip to Solve: Test numerical statements with the passage values, then reject absolute claims that contradict the stated productivity definitions.

44. For any ecosystem, a constant input of energy is the basic requirement for its functioning and sustenance. The productivity of an ecosystem is calculated as the rate of biomass production expressed as gram/square meter/year (g. m^{-2}. yr^{-1}). The rate of production of organic matter during photosynthesis is called gross primary productivity (GPP). A considerable portion of GPP is consumed and utilized by plants during respiration. Therefore, the biomass available for heterotrophs is known as net primary productivity (NPP). The rate of formation of new organic matter by consumers is known as secondary productivity (SP).

Primary productivity depends on the plants species inhabiting a particular area, availability of nutrients, photosynthetic capacity of plants, and other environmental factors. The annual NPP of whole biosphere is approximately 170 billion tons, out of which, productivity of oceans is around 55 billions tons. In soil, the dead organic matter is converted to humus through humification. Humus undergoes slow degradation and is a reservoir of soil nutrients. Over a period of time, humus is further degraded by microbes and release nutrients by a process called mineralization.

Inorganic nutrients are released into the soil by the decomposition of dead organic matter through a process called as _____ [5 marks]

(A) Photosynthesis

(B) Mineralization

(C) Purification

(D) Respiration

Correct Answer: (B) Mineralization

Solution:

Concept:

- Decomposition breaks down dead organic matter. Mineralization releases inorganic nutrients from organic material through decomposer activity, returning them to the soil nutrient pool.
- Humification produces relatively resistant humus. Its further slow microbial breakdown can release nutrients by mineralization, as described in the passage.

Step 1: Match the described conversion to its name Focus on the form of the material before and after the process. Nutrients are initially bound in dead organic matter; the question asks about their release as inorganic nutrients in soil. The passage states that humus is further degraded by microbes and nutrients are released through mineralization. This makes option (B) the direct match. Mineralization helps recycle nutrients so that plants can take them up again instead of the nutrients remaining locked in organic remains.

Step 2: Distinguish the other processes Photosynthesis, option (A), uses light energy to make organic matter from inorganic carbon; it is not the release of soil nutrients by decay. Purification, option (C), is a general term for removing unwanted substances and is not the named ecological process. Respiration, option (D), releases usable energy through oxidation of organic substrates. Although decomposers respire, respiration is not the specific term for conversion and release of organically bound nutrients in inorganic form. The nutrient-cycling result requested here is mineralization.

Step 3: Conclusion The release of inorganic nutrients into soil during decomposition is called mineralization. Hence, the correct option is (B).

Quick Tip to Solve: Distinguish humification, which forms humus, from mineralization, which releases inorganic nutrients from organic matter.

45. Which of the following units can be appropriately used in the expression of Primary Productivity of an ecosystem? [5 marks]

For any ecosystem, a constant input of energy is the basic requirement for its functioning and sustenance. The productivity of an ecosystem is calculated as the rate of biomass production expressed as gram/square meter/year (g. m^{-2}. yr^{-1}). The rate of production of organic matter during photosynthesis is called gross primary productivity (GPP). A considerable portion of GPP is consumed and utilized by plants during respiration. Therefore, the biomass available for heterotrophs is known as net primary productivity (NPP). The rate of formation of new organic matter by consumers is known as secondary productivity (SP).

Primary productivity depends on the plants species inhabiting a particular area, availability of nutrients, photosynthetic capacity of plants, and other environmental factors. The annual NPP of whole biosphere is approximately 170 billion tons, out of which, productivity of oceans is around 55 billions tons. In soil, the dead organic matter is converted to humans through humification. Humus undergoes slow degradation and is a reservoir of soil nutrients. Over a period of time, humus is further degraded by microbes and release nutrients by a process called mineralization.

(A) g m^2/yr

(B) Kg/Km^2/yr

(C) g/yr

(D) g/m/yr

Correct Answer: (B) Kg/Km^2/yr

Solution:

Concept:

- Primary productivity is the rate at which producers synthesize organic matter, expressed as biomass or energy per unit area per unit time.
- For biomass-based productivity, the dimensions are mass divided by area and time; changing grams to kilograms or square metres to square kilometres does not change those dimensions.

Step 1: Identify the required dimensions The passage describes productivity as biomass produced per square metre per year. Thus a suitable unit has the form $\text{mass}\,\text{area}^{-1}\,\text{time}^{-1}$, such as $\text{g}\,\text{m}^{-2}\,\text{yr}^{-1}$. Both an area denominator and a time denominator are necessary to compare ecosystems fairly.

Step 2: Test each printed unit Option (B), $\text{kg}\,\text{km}^{-2}\,\text{yr}^{-1}$, has exactly the required dimensions. Option (A), as printed, multiplies mass by square metres rather than dividing by area. Option (C) measures total biomass production per year without specifying area. Option (D) divides by a length rather than an area. None of these three is the appropriate area-normalized unit.

Step 3: Conclusion Primary productivity can be expressed in $\text{kg}\,\text{km}^{-2}\,\text{yr}^{-1}$. Hence, the correct option is (B).

Quick Tip to Solve: Check for three ingredients in a biomass productivity unit: mass, inverse area, and inverse time.

46. Smog, a term coined 50 years ago, from the words "Smoke" and "fog" is a dirty yellow-brown cloudy formation in lower portion of troposphere near the ground. Smog, we are most familiar with are Los Angles and London smog. Former is a example of photochemical smog, and later is a classical smog which contained sulphur dioxide, sulphur trioxide, sulphuric acid, heavy suspended particles, and water vapours. Los Angles smog was formed by photochemical reactions among nitrogen oxides and volatile hydrocarbons in presence of sunlight. This type of smog contains ozone, PAN, formaldehyde, and causes eye irritation, impairs pulmonary functions and damage plants and crops.

Choose the incorrect statement [5 marks]

(A) Smog is formed near the ground in the troposphere.

(B) Nitrogen oxides impart yellow-brown colour to smog.

(C) Photochemical smog formation is maximum when sun is overhead in the day.

(D) Photochemical smog formation is maximum in winter compared to summer season.

Correct Answer: (D) Photochemical smog formation is maximum in winter compared to summer season.

Solution:

Concept:

- Photochemical smog develops when nitrogen oxides and volatile hydrocarbons undergo reactions driven by sunlight in the lower atmosphere.
- Warm, sunny conditions favour its formation; classical London smog is instead associated with cool, humid conditions and sulphurous pollution.

Step 1: Relate the passage to the season The passage identifies Los Angeles smog as photochemical and explicitly states that sunlight drives reactions between nitrogen oxides and volatile hydrocarbons. Strong summer sunshine favours these reactions, whereas shorter days and weaker winter sunlight generally reduce their photochemical rate. Thus maximum formation in winter compared with summer is the incorrect general statement.

Step 2: Check the remaining statements Option (A) agrees with the passage: the smog occurs near the ground in the troposphere. Option (B) is consistent with the brown colour associated particularly with nitrogen dioxide. Option (C) expresses the textbook association of strong daytime sunshine with rapid photochemical reactions. The question contrasts these favourable sunny conditions with winter; it does not ask for an exact local hour of the peak ozone concentration.

Step 3: Conclusion The incorrect statement is that photochemical smog formation is maximum in winter compared with summer. Hence, the correct option is (D).

Quick Tip to Solve: Distinguish sunny summer photochemical smog from cool, humid classical smog before judging seasonal statements.

47. Smog, a term coined 50 years ago, from the words "Smoke" and "fog" is a dirty yellow-brown cloudy formation in lower portion of troposphere near the ground. Smog, we are most familiar with are Los Angles and London smog. Former is a example of photochemical smog, and later is a classical smog which contained sulphur dioxide, sulphur trioxide, sulphuric acid, heavy suspended particles, and water vapours. Los Angles smog was formed by photochemical reactions among nitrogen oxides and volatile hydrocarbons in presence of sunlight. This type of smog contains ozone, PAN, formaldehyde, and causes eye irritation, impairs pulmonary functions and damage plants and crops.

Smog clouds of sulphur dioxide, water droplets and sulphuric acid droplets can be referred to as_____. [5 marks]

(A) Photochemical smog

(B) Oxidising smog

(C) Los Angles smog

(D) Reducing smog

Correct Answer: (D) Reducing smog

Solution:

Concept:

- Classical or London smog is a mixture of smoke, fog and sulphurous pollutants, including sulphur dioxide and sulphuric acid droplets.
- It is conventionally called reducing smog, whereas the ozone-rich photochemical smog of Los Angeles is called oxidising smog.

Step 1: Identify the sulphurous mixture The question names sulphur dioxide, water droplets and sulphuric acid droplets. These are the characteristic ingredients of classical smog described in the passage, together with suspended particles. This mixture is associated with burning sulphur-containing fuels under cool, humid conditions, when fog and smoke remain trapped close to the ground.

Step 2: Match the conventional classification Classical London smog is termed reducing smog, giving option (D). Photochemical smog in option (A) instead forms through sunlight-driven reactions of nitrogen oxides and volatile hydrocarbons. Oxidising smog in option (B) and Los Angeles smog in option (C) are alternative descriptions of that photochemical type, whose characteristic pollutants include ozone and PAN. They do not name the sulphurous fog mixture asked about here.

Step 3: Conclusion Smog containing sulphur dioxide, water droplets and sulphuric acid droplets is reducing smog. Hence, the correct option is (D).

Quick Tip to Solve: Use sulphur dioxide plus fog as the clue for classical reducing smog; ozone plus sunlight points to oxidising smog.

48. Smog, a term coined 50 years ago, from the words "Smoke" and "fog" is a dirty yellow-brown cloudy formation in lower portion of troposphere near the ground. Smog, we are most familiar with are Los Angles and London smog. Former is a example of photochemical smog, and later is a classical smog which contained sulphur dioxide, sulphur trioxide, sulphuric acid, heavy suspended particles, and water vapours. Los Angles smog was formed by photochemical reactions among nitrogen oxides and volatile hydrocarbons in presence of sunlight. This type of smog contains ozone, PAN, formaldehyde, and causes eye irritation, impairs pulmonary functions and damage plants and crops.

Which of the following is not essentially required for photochemical smog formation? [5 marks]

(A) Nitrogen oxides

(B) Sunlight

(C) Water Vapour

(D) Volatile hydrocarbons

Correct Answer: (C) Water Vapour

Solution:

Concept:

- Photochemical smog is produced by sunlight-driven reactions involving nitrogen oxides and volatile hydrocarbons in air.
- The term photochemical identifies the energy source: light initiates reactions that generate secondary pollutants such as ozone and PAN.

Step 1: List the necessary conditions from the passage The passage states that Los Angeles smog forms by photochemical reactions among nitrogen oxides and volatile hydrocarbons in the presence of sunlight. Nitrogen oxides provide the nitrogen-containing reactants; volatile hydrocarbons participate in the reaction network, and sunlight supplies the energy needed to initiate photochemical processes. These correspond to options (A), (D) and (B).

Step 2: Separate humidity from the defining requirements Water vapour can be present in the atmosphere and influence atmospheric chemistry, but it is not an essential ingredient in the basic textbook description of photochemical smog. Water droplets and fog are more directly associated with the classical sulphurous smog described in the passage. Therefore option (C) is the one that is not essentially required; rejecting it does not imply that humid air can never contain photochemical smog.

Step 3: Conclusion Water vapour is not essentially required for photochemical smog formation. Hence, the correct option is (C).

Quick Tip to Solve: For photochemical smog, recall the trio: nitrogen oxides, volatile hydrocarbons and sunlight; fog is the classical-smog clue.

49. Smog, a term coined 50 years ago, from the words "Smoke" and "fog" is a dirty yellow-brown cloudy formation in lower portion of troposphere near the ground. Smog, we are most familiar with are Los Angles and London smog. Former is a example of photochemical smog, and later is a classical smog which contained sulphur dioxide, sulphur trioxide, sulphuric acid, heavy suspended particles, and water vapours. Los Angles smog was formed by photochemical reactions among nitrogen oxides and volatile hydrocarbons in presence of sunlight. This type of smog contains ozone, PAN, formaldehyde, and causes eye irritation, impairs pulmonary functions and damage plants and crops.

Which of the following is not formed during Photochemical smog formation? [5 marks]

(A) Ozone

(B) Aldehydes

(C) Peroxy acetyl nitrate

(D) Sulphuric Acid

Correct Answer: (D) Sulphuric Acid

Solution:

Concept:

- Photochemical smog is an oxidising mixture produced when nitrogen oxides and volatile hydrocarbons react in sunlight. Ozone, aldehydes and peroxyacetyl nitrate (PAN) are characteristic secondary pollutants in this mixture.
- Classical London smog is associated with smoke, fog and sulphur compounds. The passage places sulphur dioxide, sulphur trioxide and sulphuric acid in this classical-smog category.

Step 1: Identify the products named in the passage The passage explicitly states that Los Angeles smog contains ozone, PAN and formaldehyde. Los Angeles smog is the photochemical type, so the listed substances belong to the products sought in the question. Formaldehyde is an aldehyde, meaning that the broader option "Aldehydes" includes a product specifically named in the passage.

Step 2: Eliminate the three photochemical products Ozone, option (A), forms through sunlight-driven reactions involving nitrogen oxides. Aldehydes, option (B), form during the oxidation of hydrocarbons; formaldehyde is the example given. Peroxy acetyl nitrate, option (C), is PAN, another photochemical-smog constituent identified directly in the passage. These three options therefore cannot answer the negative question asking which substance is not formed in the characteristic photochemical-smog process.

Step 3: Distinguish the sulphur-based pollutant Sulphuric acid, option (D), belongs to the sulphur-based classical-smog description in this passage. Oxidation of sulphur dioxide to sulphur trioxide, followed by reaction with water, can produce this acid. That sequence is associated here with London smog rather than the nitrogen-oxide and hydrocarbon chemistry used to distinguish Los Angeles photochemical smog.

Step 4: Conclusion Sulphuric acid is the substance not classed as a product of photochemical smog in the passage. Hence, the correct option is (D).

Quick Tip to Solve: For this negative question, group ozone, aldehydes and PAN together as photochemical products; the sulphur-based acid identifies classical smog.

50. Smog, a term coined 50 years ago, from the words "Smoke" and "fog" is a dirty yellow-brown cloudy formation in lower portion of troposphere near the ground. Smog, we are most familiar with are Los Angles and London smog. Former is a example of photochemical smog, and later is a classical smog which contained sulphur dioxide, sulphur trioxide, sulphuric acid, heavy suspended particles, and water vapours. Los Angles smog was formed by photochemical reactions among nitrogen oxides and volatile hydrocarbons in presence of sunlight. This type of smog contains ozone, PAN, formaldehyde, and causes eye irritation, impairs pulmonary functions and damage plants and crops.

Choose the correct statement [5 marks]

(A) Ozone formed during photochemical smog protects us from UV radiations.

(B) Increase in tropospheric ozone can reduce food production.

(C) Photochemical smog formation is maximum in morning and evening due to heavy traffic hours.

(D) Vehicular exhaust does not contain any precursors of ozone formation in the troposphere.

Correct Answer: (B) Increase in tropospheric ozone can reduce food production.

Solution:

Concept:

- Ozone has different environmental roles at different atmospheric levels. Stratospheric ozone absorbs harmful ultraviolet radiation, whereas elevated ground-level or tropospheric ozone is an air pollutant that damages living tissues.
- Photochemical smog develops when sunlight drives reactions involving nitrogen oxides and volatile organic compounds. Motor vehicles can emit these precursors even though ozone itself is largely formed secondarily in the air.

Step 1: Connect ozone exposure with crop damage The passage says photochemical smog damages plants and crops. Tropospheric ozone is a strong oxidant: it enters leaves through stomata and injures cells, impairing photosynthesis and growth. Lower crop yields reduce food production, supporting statement (B).

Step 2: Separate protective ozone from harmful ozone Statement (A) confuses two locations in the atmosphere. The protective ozone layer lies in the stratosphere, well above the ground. Ozone produced in photochemical smog lies in the lower troposphere and is harmful to health and vegetation. Its presence near ground level is therefore not described as the protective ultraviolet shield in this question.

Step 3: Check the sunlight requirement and emission sources Statement (C) incorrectly equates rush-hour traffic with maximum smog formation. Traffic supplies reactants, but photochemical reactions need strong sunlight; products can build up later in the day rather than peak during both morning and evening traffic hours. Statement (D) is false because exhaust supplies nitrogen oxides and unburnt hydrocarbons, the precursors for tropospheric ozone formation.

Step 4: Conclusion An increase in tropospheric ozone can reduce food production by damaging crops and lowering their productivity. Hence, the correct option is (B).

Quick Tip to Solve: Identify ozone's altitude first: stratospheric ozone shields against UV, while excess tropospheric ozone injures lungs and crops.