INDIAN SCHOOL AL WADI AL KABIR		
CLASS: XII	**DEPARTMENT: SCIENCE 2026 – 2027** **SUBJECT: BIOLOGY**	**DATE: 08/11/2026**
WORKSHEET NO. 12	**UNIT- X-ECOLOGY** **CHAPTER 12 - ECOSYSTEM**	**NOTE:** **A4 FILE FORMAT**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

I. OBJECTIVE-TYPE QUESTIONS

1. In an ecosystem, the total organic matter produced by plants during photosynthesis is 24,000 kcal m^{-2} yr^{-1}. If 40% of this energy is utilised in respiration, the net primary productivity will be:
   A. 9,600 kcal m^{-2} yr^{-1}
   B. 14,400 kcal m^{-2} yr^{-1}
   C. 24,000 kcal m^{-2} yr^{-1}
   D. 33,600 kcal m^{-2} yr^{-1}
2. Which of the following combinations correctly represents the processes involved in decomposition?
   A. Fragmentation – Earthworms; Humification – Formation of humus; Mineralisation – Release of inorganic nutrients
   B. Leaching – Formation of humus; Catabolism – Absorption of sunlight; Mineralisation – Formation of detritus
   C. Fragmentation – Release of nutrients; Humification – Breakdown by enzymes; Leaching – Formation of humus
   D. Catabolism – Formation of detritus; Mineralisation – Formation of humus; Leaching – Fragmentation
3. In a terrestrial ecosystem, a larger fraction of energy flows through the detritus food chain than through the grazing food chain. Which of the following best explains this?
   A. Producers are absent in terrestrial ecosystems.
   B. A large amount of dead organic matter is available as detritus.
   C. Decomposers depend directly on sunlight.
   D. Energy transfer is higher in the detritus food chain.
4. Consider the following statements about decomposition:
   I. Decomposition is largely an oxygen-requiring process.
   II. Detritus rich in lignin and chitin decomposes rapidly.
   III. Warm and moist conditions favour decomposition.
   IV. Low temperature and anaerobic conditions inhibit decomposition.
   Choose the correct option:
   A. I and II only
   B. II and III only
   C. I, III and IV only
   D. I, II, III and IV
5. An ecosystem has the following energy distribution:
   Producers = 20,000 J
   Primary consumers = 2,000 J

Secondary consumers = 200 J
If the 10% law operates, the energy available to tertiary consumers will be:
A. 100 J
B. 20 J
C. 200 J
D. 2 J

6. Which of the following ecological pyramids is always upright, irrespective of the type of ecosystem?
   A. Pyramid of numbers
   B. Pyramid of biomass
   C. Pyramid of energy
   D. Both (a) and (b)
7. A single tree supports numerous insects, which in turn support several small birds. This type of ecological pyramid is most likely to be:
   A. Upright pyramid of numbers
   B. Inverted pyramid of numbers
   C. Upright pyramid of biomass
   D. Inverted pyramid of energy
8. A sparrow feeds on both seeds and insects. Based on this feeding habit, which statement is correct?
   A. It always occupies the second trophic level.
   B. It always occupies the third trophic level.
   C. It may occupy more than one trophic level in the same ecosystem.
   D. It cannot be considered a consumer.

II. ASSERTION AND REASONING

For Questions 9–12, choose the correct option:

A. Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
B. Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
C. Assertion is true, but Reason is false.
D. Assertion is false, but Reason is true.

9. **Assertion:** Net primary productivity represents the biomass available for consumption by heterotrophs.
   Reason: NPP is obtained by subtracting respiratory losses from gross primary productivity.

10. **Assertion:** Decomposition is faster when detritus contains a high proportion of lignin and chitin.
    Reason: Detritus rich in nitrogen and water-soluble substances such as sugars decomposes faster.

11. **Assertion:** The pyramid of biomass in an aquatic ecosystem is generally inverted.
    Reason: The standing crop of phytoplankton is small, but it can support a larger standing crop of zooplankton.

12. **Assertion:** Energy flow in an ecosystem is unidirectional.
    Reason: Energy is lost as heat during transfer from one trophic level to the next and cannot be recycled.

III. VERY SHORT QUESTIONS (2M):

13. Why is the measurement of biomass in terms of dry weight considered more accurate than fresh weight? Explain.
14. Differentiate between humification and mineralisation with respect to their products and significance in an ecosystem.
15. Why does the energy flow through the detritus food chain form a major pathway in terrestrial ecosystems, whereas the grazing food chain is the major pathway in aquatic ecosystems?
16. A producer has 50,000 J of energy available. Calculate the energy available at the second and fourth trophic levels, assuming the 10% law operates.
17. State any two limitations of ecological pyramids.

IV. SHORT ANSWER TYPE QUESTIONS: (3M)

18. Differentiate between Gross Primary Productivity, Net Primary Productivity and Secondary Productivity.
19. Explain the concept of trophic levels using a suitable food chain. Why is the number of trophic levels in a grazing food chain restricted?
20. Explain why ecological pyramids of numbers and biomass may be inverted, whereas the pyramid of energy is always upright. Give suitable examples.
21. A forest ecosystem contains producers, herbivores, carnivores and decomposers.
    a) Identify the trophic level occupied by producers and primary consumers.
    b) Explain how energy is transferred between successive trophic levels.
    c) What happens to the dead organic matter in this ecosystem?

V. SOURCE-BASED/ CASE STUDY-BASED QUESTIONS

22. **Read the passage carefully and answer the questions that follow.**
    A student studied an aquatic ecosystem and observed that phytoplankton formed the base of the food chain. They were consumed by zooplankton, which were further consumed by small fishes. Larger fishes fed on the small fishes. The student also observed that the biomass of phytoplankton at a particular time was lower than that of zooplankton.

    Answer the following questions:
    A. Identify the trophic level occupied by zooplankton.
    B. Name the type of ecological pyramid represented by the biomass distribution described above.
    C. Explain how a small standing crop of phytoplankton can support a larger standing crop of zooplankton.

    OR

    D. Explain why the pyramid of energy in this aquatic ecosystem will always remain upright.

VI. LONG ANSWER TYPE QUESTIONS. (5M)

23. Explain the process of decomposition in an ecosystem under the following headings:
    a) Definition of decomposition and detritus.
    b) Explain the five steps involved in decomposition.
    c) Mention any two climatic factors affecting decomposition.
24. Describe the flow of energy in an ecosystem with the help of a suitable diagram. Include the following points in your answer:
    a) Source of energy.

b) Role of producers and consumers.
c) Grazing and detritus food chains.
d) Unidirectional flow of energy.
e) Ten per cent law.

25. What are ecological pyramids? Explain the three types of ecological pyramids with suitable examples. Also mention any two limitations of ecological pyramids.

VII.PREVIOUS YEAR BOARD QUESTIONS

26. Ecological pyramids are widely accepted, but they still have some limitations. Write any two limitations. (2026)

27. Correctly depict (also indicate the trophic level) and describe the ecological pyramid of numbers with 32 birds dependent on 20 insects feeding on one banyan tree. (2025)

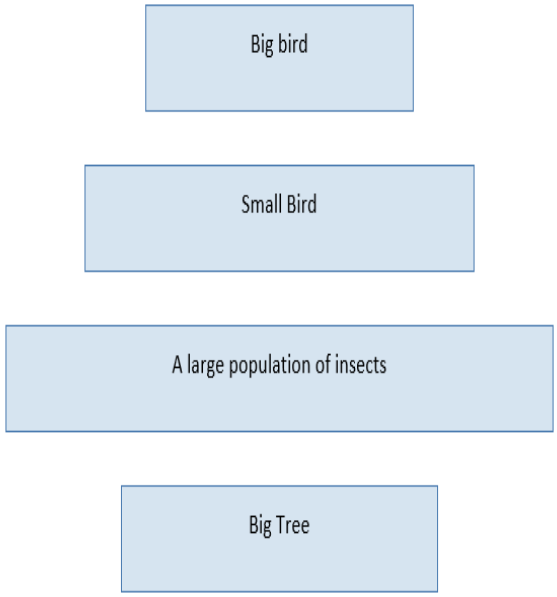
28**.** Draw a pyramid of numbers where a large population of insects feeds upon a very big tree. The insects, in turn, are eaten by small birds, which in turn are fed upon by big birds. (2025**)**

<table>
<tr><td>Q. No.</td><td></td></tr>
<tr><td colspan="2">I. OBJECTIVE-TYPE QUESTIONS</td></tr>
<tr><td>1.</td><td>B. 14,400 kcal m^{-2} yr^{-1}</td></tr>
<tr><td>2.</td><td>A. Fragmentation – Earthworms; Humification – Formation of humus; Mineralisation – Release of inorganic nutrients.</td></tr>
<tr><td>3.</td><td>B. A large amount of dead organic matter is available as detritus.</td></tr>
<tr><td>4.</td><td>C. I, III and IV only.</td></tr>
<tr><td>5.</td><td>B. 20 J</td></tr>
<tr><td>6.</td><td>C. Pyramid of energy</td></tr>
<tr><td>7.</td><td>B. Inverted pyramid of numbers</td></tr>
<tr><td>8.</td><td>C. It may occupy more than one trophic level in the same ecosystem.</td></tr>
<tr><td colspan="2">II. <u>ASSERTION AND REASONING</u></td></tr>
<tr><td>9.</td><td>A. Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.</td></tr>
<tr><td>10.</td><td>D. Assertion is false, but Reason is true.</td></tr>
<tr><td>11.</td><td>A. Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.</td></tr>
<tr><td>12.</td><td>A. Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.</td></tr>
<tr><td colspan="2">III. VERY SHORT ANSWER TYPE QUESTIONS: (2M)</td></tr>
<tr><td>13.</td><td>Fresh weight includes variable amounts of water, which may differ among organisms and environmental conditions. Dry weight removes the effect of water content and therefore gives a more accurate measurement of biomass.</td></tr>
<tr><td>14.</td><td>
<table>
<tr><th>Humification</th><th>Mineralisation</th></tr>
<tr><td>Leads to the formation of humus.</td><td>Leads to the release of inorganic nutrients.</td></tr>
<tr><td>Humus is dark-coloured, amorphous and resistant to microbial action.</td><td>Microbes further degrade humus and release inorganic nutrients.</td></tr>
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<tr><td>15.</td><td>In terrestrial ecosystems, a large amount of dead organic matter is available as detritus; hence, more energy flows through DFC.
In aquatic ecosystems, grazing food chains form the major pathway for energy flow.</td></tr>
<tr><td>16.</td><td>Given: Energy at producer level = 50,000 J.
Second trophic level = 10% of 50,000 = 5,000 J.
Third trophic level = 500 J.
Fourth trophic level = 50 J.
Answer: 5,000 J and 50 J.</td></tr>
<tr><td>17.</td><td>Any two:
They do not accommodate food webs.
They assume a simple food chain.
The same species may occupy more than one trophic level.
Saprophytes are not represented.</td></tr>
<tr><td colspan="2">IV. SHORT ANSWER TYPE QUESTIONS (3M)</td></tr>
<tr><td>18.</td><td><table><tr><th>GPP</th><th>NPP</th><th>Secondary productivity</th></tr><tr><td>Total rate of organic matter production during photosynthesis.</td><td>Biomass remaining after respiratory losses.</td><td>Rate of formation of new organic matter by consumers.</td></tr></table>Formula: NPP = GPP − R.</td></tr>
<tr><td>19.</td><td>Trophic levels represent the feeding position of organisms in a food chain.
First level – Producers.
Second level – Primary consumers.
Third level – Secondary consumers.
Fourth level – Tertiary consumers.
Only 10% of energy is transferred to the next trophic level; hence, the number of trophic levels is restricted.</td></tr>
<tr><td>20.</td><td>Pyramid of numbers may be inverted in a tree ecosystem, where one tree supports numerous insects.
Pyramid of biomass may be inverted in aquatic ecosystems because the standing crop of phytoplankton is smaller than that of zooplankton.
Pyramid of energy is always upright because energy is lost as heat at every successive trophic level.</td></tr>
<tr><td>21.</td><td>a) Producers – First trophic level; primary consumers – Second trophic level.
b) Energy passes from producers to primary consumers and then to higher consumers. Only 10% of energy is transferred to the next trophic level.
c) Dead organic matter forms detritus. Decomposers break it down and release inorganic nutrients.</td></tr>
<tr><td colspan="2">V. SOURCE-BASED/ CASE STUDY-BASED QUESTIONS</td></tr>
<tr><td>22.</td><td>a) Second trophic level.
b) Inverted pyramid of biomass.
c) Phytoplankton have a rapid rate of production and reproduction. Although their standing crop at a particular time is small, continuous replacement allows them to support a larger standing crop of zooplankton.
OR
The pyramid of energy is always upright because energy decreases at every successive trophic level. Only 10% of energy is transferred to the next level, while the remaining energy is lost through metabolic activities and as heat.</td></tr>
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VI. LONG ANSWER TYPE QUESTIONS. (5M)	
23.	• **Decomposition:** The breakdown of complex organic matter into simple inorganic nutrients. • **Detritus:** Dead plant and animal remains that serve as the raw material for decomposition. **b) Five Steps of Decomposition** • **Fragmentation:** Detritivores (like earthworms) break detritus into smaller pieces. • **Leaching:** Water-soluble nutrients filter down into the soil. • **Catabolism:** Bacterial and fungal enzymes degrade detritus into simple compounds. • **Humification:** Formation of dark, nutrient-rich **humus** that resists microbial action. • **Mineralisation:** Breakdown of humus by microbes to release inorganic minerals. **c) Two Climatic Factors** • **Temperature:** Warmth speeds up microbial activity; cold slows it down. • **Moisture:** Adequate moisture accelerates decomposition; drought or waterlogging inhibits it.
24.	**a) Source of Energy** The Sun is the primary source of energy for all ecosystems on Earth. Less than 50% of incoming solar radiation is Photosynthetically Active Radiation (PAR), and plants trap only 2–10% of this PAR to sustain life. **b) Role of Producers and Consumers** • **Producers (Autotrophs):** Green plants fix solar energy and convert it into chemical energy (food) via photosynthesis. They form the base of every ecosystem. • **Consumers (Heterotrophs):** Animals that cannot make food. They must eat plants (**herbivores**) or other animals (**carnivores**) to obtain energy. **c) Grazing and Detritus Food Chains** • **Grazing Food Chain (GFC):** Begins with living green plants, moving to herbivores, and then to. It is the major energy pathway in aquatic ecosystems. • **Detritus Food Chain (DFC):** Begins with dead organic matter (detritus) and moves to decomposers like fungi and bacteria. It is the major energy pathway in terrestrial ecosystems. **d) Unidirectional Flow of Energy** Energy flow is strictly one-way (unidirectional). Energy captured from the sun moves up sequentially through the trophic levels from producers to consumers. It can never flow backward (e.g., consumers cannot pass energy back to plants, and plants cannot return energy to the sun). **e) Ten Per Cent Law** Proposed by Lindeman, this law states that only 10% of the energy is transferred from one trophic level to the next higher level. The remaining 90% of energy is lost to the environment as metabolic heat during respiration and life processes, which limits food chains to 4–5 levels.
25.	**Pyramid of Numbers** o It represents the total number of individual organisms at each trophic level.

	○ **Example (Upright):** In a **grassland ecosystem**, millions of blades of grass (producers) support a smaller number of grasshoppers (primary consumers), which support even fewer frogs, ending with a very small number of hawks (top carnivores). ○ *Note:* It can be inverted, such as a single tree supporting thousands of insects. **Pyramid of Biomass** ○ It represents the total dry weight (organic matter) of organisms at each trophic level at a given time. ○ **Example (Upright):** In a **forest ecosystem**, the massive weight of trees forms a broad base, while the total biomass of herbivores (deer, rabbits) and carnivores (wolves) decreases progressively at each higher level. ○ *Note:* It is inverted in aquatic ecosystems, where a small biomass of phytoplankton supports a larger biomass of zooplankton and fish. **Pyramid of Energy** It represents the total amount of energy present at each trophic level per unit area over a specific time frame.
VII	**PREVIOUS YEARS BOARD QUESTIONS:**
26.	• It does not take into account the same species belonging to two or more trophic levels. • It assumes a simple food chain, something that rarely exists in nature. • It does not accommodate a food web. • Saprophytes are not given any place in ecological pyramids even though they play a vital role in the ecosystem
27.	The ecological pyramid of numbers represents the number of individuals at each trophic level in an ecosystem. In this case, we have: • **Primary Producers (Banyan Tree):** The base of the pyramid consists of one banyan tree, which is a producer (autotroph). It forms the first trophic level. • **Primary Consumers (Insects):** At the second level, 20 insects feed on the banyan tree, making them the primary consumers. They depend directly on the producer for energy. • **Secondary Consumers (Birds):** The third level consists of 32 birds that feed on the insects, making them secondary consumers. These birds depend on the primary consumers (insects) for food.

28.	 In this situation, the pyramid of numbers is inverted: a single tree feeds a vast population of insects, which in turn supports a smaller population of small birds, and an even smaller population of giant birds at the top.

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