Our Environment

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. In the food chain grass → deer → lion, the deer is a:

(a) primary consumer (herbivore) **(b)** tertiary consumer
(c) producer **(d)** secondary consumer

2. In the food chain wheat → rat → owl, the producers hold 2,000 J of energy. By the 10 per cent law, how much reaches the owl?

(a) 2 J **(b)** 200 J **(c)** 1,800 J **(d)** 20 J

3. Organisms that make their own food using sunlight are called:

(a) decomposers **(b)** parasites **(c)** consumers **(d)** producers

4. Which of these is non-biodegradable?

(a) A plastic toy **(b)** A wooden spoon **(c)** A jute bag **(d)** Paper

5. A pesticide that is not broken down gets into the food chain leaves → caterpillar → sparrow → hawk. Which organism will have the highest concentration of it?

(a) Sparrow **(b)** Leaves **(c)** Caterpillar **(d)** Hawk

6. Plants in a field store 1,000 kJ of energy, and the grasshoppers that eat them get 150 kJ. What percentage of the energy is passed on?

(a) 8% **(b)** 10% **(c)** 15% **(d)** 12%

7. Which of these is a carnivore?

(a) Algae **(b)** A rabbit **(c)** An owl **(d)** Bread mould

8. Assertion (A): In the food chain leaves → caterpillar → sparrow → hawk, if the producers hold 10,000 J, the hawk gets about 10 J.
Reason (R): About 90% of the energy at one trophic level passes on to the next.

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. In the food chain algae → water flea → small fish → kingfisher, the producers hold 20,000 kJ. Using the 10 per cent law, find the energy at each of the other levels.

10. Name the trophic level of each organism in the food chain leaves → caterpillar → sparrow → hawk.

11. A pond has 0.02 ppm of a pesticide. Its concentration becomes 5 times higher at each trophic level, starting with the producers (5 × the water). In the food chain grass → grasshopper → frog → snake → eagle, what is its concentration in the grasshopper?

12. Why are food chains usually limited to three or four trophic levels?

13. Classify as biodegradable or non-biodegradable: a plastic toy; used tea leaves; paper; a thermocol cup.

14. In the food chain grain → mouse → snake → peacock, the peacock gets 2 J of energy. By the 10 per cent law, how much energy must the grain have held?

15. In the food chain grass → insect → frog → snake, the grass holds 50,000 kJ and the insect gets 10,000 kJ. What percentage is passed on? Is it more than, less than or equal to what the 10 per cent law predicts?

16. In the food chain phytoplankton → zooplankton → fish → fish-eating bird, what would happen to the numbers of zooplankton and fish-eating bird if all the fish were removed?

Section C — Word problems — 4 × 4 = 16 marks

17. Explain the flow of energy in an ecosystem using the 10 per cent law.

18. Sunlight falling on a field gives 1,000,000 J of energy. The leaves capture 1% of it. In the food chain leaves → caterpillar → sparrow → hawk, find the energy at each level using the 10 per cent law. Why can this chain not be very long?

19. Water in a lake has 0.05 ppm of a pesticide. Its concentration is 10 times higher at each trophic level than at the one below (the producers have 10 times the water). For the food chain grain → mouse → snake → peacock: (a) find the concentration in each organism; (b) how many times the concentration in water is it in the peacock? (c) What is this effect called?

20. Arrange these organisms into a food chain: frog, insect, grass, snake. Name the trophic level of each. Which level has the most energy, and which would have the most of a pesticide that is not broken down?

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Answer key

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Q	Answer	Working
1	**(a) primary consumer (herbivore)**	trophic level 2
2	**(d) 20 J**	$2{,}000 \times (1/10)^2$
3	**(d) producers**	—
4	**(a) A plastic toy**	microbes cannot break it down
5	**(d) Hawk**	its concentration rises at each trophic level (biological magnification)
6	**(c) 15%**	150 ÷ 1,000 × 100
7	**(c) An owl**	—
8	**(c) A is true, but R is false.**	A is true: $10{,}000 \times (1/10)^3 = 10$ J. R is false.
9	**water flea: 2,000 kJ; small fish: 200 kJ; kingfisher: 20 kJ**	divide by 10 at each step
10	**leaves: producer; caterpillar: primary consumer (herbivore); sparrow: secondary consumer; hawk: tertiary consumer**	—
11	**0.5 ppm**	0.02×5^2
12	**Only about 10% of the energy passes to each next level, so after three or four levels too little energy is left to support another level.**	—
13	**a plastic toy: non-biodegradable; used tea leaves: biodegradable; paper: biodegradable; a thermocol cup: non-biodegradable**	—
14	**2,000 J**	× 10 for each of 3 steps down
15	**20%; more than 10%**	10,000 ÷ 50,000 × 100
16	**The zooplankton would increase (nothing eats them) and the fish-eating bird would decrease (they lose their food).**	—
17	**Producers capture about 1% of the sunlight falling on them and change it into chemical energy. Herbivores get about 10% of the energy in the plants they eat; carnivores get about 10% of that. The rest is used in life processes or lost as heat. So energy flows in one direction and decreases at each level, which limits food chains to 3–4 levels.**	—

Q	Answer	Working
18	**leaves: 10,000 J; caterpillar: 1,000 J; sparrow: 100 J; hawk: 10 J. Very little energy is left at the top, too little to support another level.**	1,000,000 × 1% = 10,000 J; then divide by 10 at each level
19	**(a) grain: 0.5 ppm; mouse: 5 ppm; snake: 50 ppm; peacock: 500 ppm. (b) 10,000 times. (c) Biological magnification.**	multiply by 10 at each step
20	**grass → insect → frog → snake. grass: producer; insect: primary consumer (herbivore); frog: secondary consumer; snake: tertiary consumer. Most energy: the grass; most pesticide: the snake.**	—

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