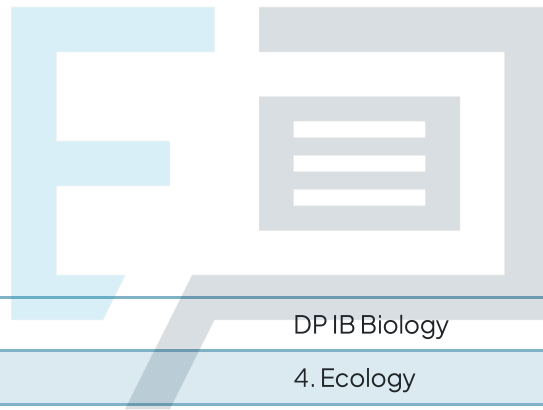


4.1 Species, Communities, Ecosystems & Energy Flow

Mark Schemes



Course	DPIB Biology
Section	4. Ecology
Topic	4.1 Species, Communities, Ecosystems & Energy Flow
Difficulty	Medium

To be used by all students preparing for DP IB Biology HL
Students of other boards may also find this useful



1

The correct answer is **C** because a population is all of the organisms of the **same species** living in an area at any one time.

A, **B**, and **D** all refer to groups of organisms of more than one species. **A** describes an ecosystem, while **D** describes a community.

2

The correct answer is **B** because it correctly identifies sea cucumbers as detritivores and gives a correct definition of a detritivore. We can tell from the description that sea cucumbers ingest their food **internally** because it states that they pick up and consume food particles and that they have a mouth.

A is incorrect because the explanation incorrectly states that detritivores carry out external digestion; this applies to saprotrophs rather than detritivores, and does not match with the description of sea cucumber feeding provided.

C and **D** both give incorrect modes of nutrition for the description of sea cucumber feeding provided.

3

The correct answer is **C** because statement **I** is incorrect. Autotrophs gain all of their inorganic nutrients from the abiotic environment, but heterotrophs gain some of their inorganic nutrients from other organisms in their food.

A, **B**, and **D** are incorrect because they include statement **I**

4

The correct answer is **D** because while nutrients can be constantly cycled, energy is lost from ecosystems in the form of heat; this lost energy cannot be recycled, so must be replaced by light energy from the sun which enters ecosystems by photosynthesis.

A is incorrect because ecosystems always require light energy from the sun.

B is incorrect because while it correctly describes the cycling of nutrients, it doesn't explain why ecosystems are sustainable; sustainability requires energy, not just nutrient availability.

C is incorrect because energy is not recycled.

5

The correct answer is **A** because it states that the theory of energy loss at each trophic level can explain the observed phenomenon that food chains are short.

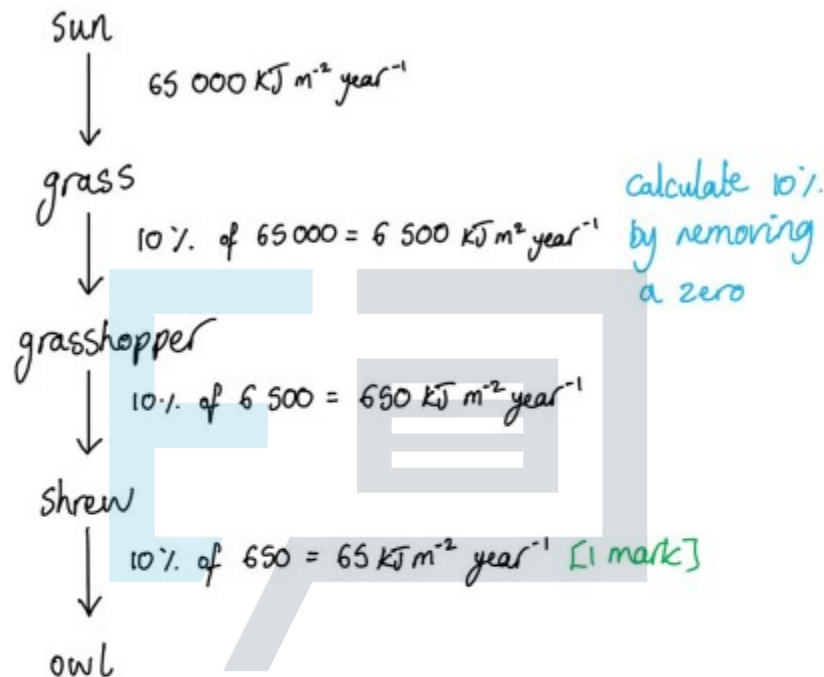
B is an observation of the natural phenomenon of reducing biomass, but contains no explanation.

C contains a theory about heat loss but no observed natural phenomenon.

D is a hypothesis that would need to be tested, and is not a theory or an example of a natural phenomenon.

6

The correct answer is **D** because, assuming a roughly 10% efficiency of energy transfer, 90% of the energy gained is lost at each trophic level.



Exam Papers Practice

7

The correct answer is **A** because statement I is the only correct statement.

B, **C**, and **D** all contain statements II, III, or both.

Random samples cannot be achieved by throwing a quadrat as this can be affected by throwing ability. A random number generator must be used.

Quadrats can be of any size to incorporate any size of organism; their use is, however, limited to sessile organisms (organisms that are fixed in place eg. by attachment to the ground via a stalk or foot).

8

The correct answer is **C** because the chi-squared value is larger than the critical value at a probability level of 0.05, or 5%.

For **A** to be correct the chi-squared value would need to be smaller than the critical value at the 5% probability level.

B could be the explanation for the conclusion reached in statement **C**, but the chi-squared test alone does not provide the evidence to reach this conclusion.

D is incorrect because the chi-squared value is smaller than the critical value at a probability level of 0.01, or 1%.

There is 1 degree of freedom (d.f.)

5% probability level

1% probability level

Degrees of freedom	0.1	0.05	0.01	0.001
1	2.71	3.84	6.64	10.83
2	4.60	5.99	9.21	13.82

critical value at 5% probability level and 1 d.f.

critical value at 1% probability level and 1 d.f.

chi-squared value of 5.89 > 3.84 but < 6.64

Exam Papers Practice



9

The correct answer is **C** because:

- A transparent container allows light to reach the producers
- Secondary consumers should not be included for ethical reasons; they will eat the primary consumers, and there is unlikely to be enough for them
- Autotrophs are needed to convert light energy into chemical energy
- A control mesocosm allows researchers to be sure that any results are due to the variable being studied.

A is incorrect because the container used must be transparent to allow light to enter.

B is incorrect because food chains must be limited to a length of 2 organisms; 3 would include a secondary consumer.

D is incorrect because the soil microorganisms are an essential part of a sustainable ecosystem.

10

The correct answer is **D** because it shows a stepped pyramid with the correct labels and units.

A has incorrect labels and incorrect units; bars on a pyramid should be labelled 'producer, primary consumer etc. rather than with organism names.

B shows a smooth sided pyramid rather than a stepped pyramid.

C has incorrect units.