

Productivity and ecosystems: practice questions

9 questions · 34 marks · mark scheme at the back

 For Pearson Edexcel International AS Biology XBI11 and International A Level Biology YBI11. **A Level only** is IA2 content (Units 4 to 6), not needed for the International AS.

Name

Total / 34

1 UNIT 4 STYLE [1 mark]

A crop has a gross primary productivity of $15\,000\text{ kJ m}^{-2}\text{ year}^{-1}$ and loses $6\,000\text{ kJ m}^{-2}\text{ year}^{-1}$ in respiration. What is its net primary productivity?

- A . ☐ $6\,000\text{ kJ m}^{-2}\text{ year}^{-1}$
- B . ☐ $9\,000\text{ kJ m}^{-2}\text{ year}^{-1}$
- C . ☐ $15\,000\text{ kJ m}^{-2}\text{ year}^{-1}$
- D . ☐ $21\,000\text{ kJ m}^{-2}\text{ year}^{-1}$

2 UNIT 4 STYLE [4 marks]

The table shows the energy flow through part of a grassland ecosystem. Calculate the net primary productivity of the grass, and the percentage efficiency of energy transfer from the energy available in the grass (its NPP) to the grasshoppers.

Energy flow in a grassland ($\text{kJ m}^{-2}\text{ year}^{-1}$)	
Quantity	Energy / $\text{kJ m}^{-2}\text{ year}^{-1}$
Gross primary productivity of grass	9 800
Energy lost by grass in respiration	2 600
Energy in grasshoppers (primary consumers)	720

Answer = ...

3 UNIT 4 STYLE [4 marks]

Explain why the efficiency of energy transfer from a primary consumer to a secondary consumer is less than 100%.

[illegible]

4 UNIT 4 STYLE [3 marks]

State what is meant by the terms population, community and ecosystem, using a named habitat as an example.

[illegible]

5 UNIT 4 STYLE [4 marks]

A student studied the distribution of a species of limpet on a rocky shore and found it mostly on the lower shore. Suggest how one abiotic factor and one biotic factor could explain this distribution.

[illegible]

6

UNIT 4 STYLE

[4 marks]

Two species of tit feed on insects in the same woodland. One feeds mostly in the canopy, and the other feeds mostly near the ground. Use the concept of niche to explain how both species can live in the same woodland.

7

UNIT 6 STYLE

[6 marks]

Describe how you would investigate the distribution of a species of plant along a transect from a path into a woodland, and how you would find out whether its distribution is linked to light intensity.

8

UNIT 6 STYLE

[3 marks]

A student placed twelve 0.25 m² quadrats at random in a meadow of area 4 800 m² and counted 54 buttercup plants in total. Estimate the number of buttercup plants in the meadow.

Answer = ...

Describe and explain the changes that occur in a community during primary succession on bare rock, from pioneer species to a climax community.

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Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B: $\text{NPP} = \text{GPP} - \text{R} = 15\,000 - 6\,000 = 9\,000 \text{ kJ m}^{-2} \text{ year}^{-1}$.

2. [4]

- $\text{NPP} = \text{GPP} - \text{R} = 9\,800 - 2\,600$ (1)
- $= 7\,200 \text{ kJ m}^{-2} \text{ year}^{-1}$ (1)
- $\text{efficiency} = 720 \div 7\,200 \times 100$ (1) (accept error carried forward from NPP)
- $= 10 \%$ (1)

3. [4]

- some of the primary consumer is not eaten (for example bones, fur, teeth) (1)
- some of what is eaten is not digested and is lost as faeces (egestion) (1)
- some energy is lost in excretory products such as urea (1)
- energy is lost as heat from respiration, which is used for movement / maintaining body temperature / active transport (1)
- some primary consumers die of other causes and pass to decomposers (1)
- Max 4

4. [3]

- population: all the organisms of one species in the habitat at the same time (1)
- community: all the populations of different species living (and interacting) in the habitat (1)
- ecosystem: the community together with the abiotic (non-living) environment (1)
- suitable named example (for example a pond / woodland) used correctly (1)
- Max 3

5. [4]

- abiotic: the lower shore is covered by sea water for longer, so the limpets are less likely to dry out / less desiccation (1)
- abiotic: temperature / salinity is more stable (less extreme) on the lower shore (1)
- biotic: more algae / food on the lower shore (accept limpets are submerged for longer so have more time to graze) (1)
- biotic: less time exposed to predators that feed at low tide, such as birds (1)
- a clear link between each factor and the survival / reproduction / numbers of the limpets (1)
- Max 4 (max 2 for abiotic and max 2 for biotic)

6. [4]

- niche is the role of a species in its habitat / how it interacts with its environment (1)
- the two species have different niches / different feeding positions (1)
- so less interspecific competition for food (1)
- if niches were the same, one species would outcompete the other / be excluded (1)
- each population is controlled by the food available in its part of the habitat (accept intraspecific competition) (1)
- Max 4

7. [6]

- tape measure laid out at right angles to the path / along the line from the path into the wood (1)
- quadrats placed at regular intervals (for example every 2 m) along the line (interrupted belt transect) (1)
- in each quadrat record the abundance of the species / percentage cover / number of plants (1)
- use of the same size quadrat each time (accept 0.25 m²) (1)
- measure light intensity at each quadrat using a light meter, held at the same height and orientation (1)
- repeat the transect / use several transects and calculate means (1)
- plot a graph of abundance against distance and light intensity / carry out a correlation test (1)
- link: correlation does not prove causation (accept other factors such as soil moisture could vary) (1)
- Max 6

8. [3]

- area sampled = $12 \times 0.25 = 3 \text{ m}^2$, so mean = $54 \div 3 = 18 \text{ per m}^2$ (1)
- population = $18 \times 4\,800$ (1)
- = 86 400 (1) (no mark for the unit; accept 86 400 plants)

9. [5]

- pioneer species (for example lichens / mosses) colonise the bare rock (1)
- they tolerate harsh conditions / lack soil / photosynthesise (1)
- when they die and decompose they add organic matter, which forms soil / increases nutrients and water retention (1)
- the abiotic conditions become less hostile, so other species (grasses, shrubs) can colonise and outcompete the pioneers (1)
- diversity and biomass increase / food webs become more complex (1)
- eventually a stable climax community forms, with no further net change in species, in balance with the climate (1)
- Max 5