

Ecosystems (Form and function) practice questions

15 questions • 47 marks • mark scheme at the back

For IB Diploma Biology, Standard Level and Higher Level (first assessment 2025). **HL only** is additional higher level content, for HL students only.

Name

Total / 47

Adaptation to environment **Spec B4.1**

1 PAPER 1A STYLE [1 mark]

Which statement correctly describes a habitat?

- A. ☐ The role of a species in an ecosystem, including how it obtains food
- B. ☐ The place in which a community, species, population or organism lives
- C. ☐ All the populations of different species living and interacting in an area
- D. ☐ The range of an abiotic factor within which a species can survive

2 PAPER 1A STYLE [1 mark]

Why do coral reefs form mainly in shallow water, usually less than about 30 m deep?

- A. ☐ The water pressure dissolves calcium carbonate skeletons
- B. ☐ The salinity of deep water is too high for coral polyps
- C. ☐ Too little light reaches the zooxanthellae for photosynthesis
- D. ☐ The water is too warm for coral polyps to survive

3 PAPER 1A STYLE [1 mark]

Cacti in American deserts and spurges in African deserts are not closely related, but both have succulent stems, spines and reduced leaves. What explains this similarity?

- A. ☐ Convergent evolution under similar selection pressures
- B. ☐ Inheritance of the features from a recent common ancestor
- C. ☐ Competitive exclusion between the two groups
- D. ☐ Adaptive radiation from a single desert species

4 PAPER 2A STYLE**[4 marks]**

Explain how a named tree species is adapted to the abiotic conditions of a mangrove swamp.

5 PAPER 1B STYLE**[5 marks]**

Students used a belt transect from the edge of a woodland into its interior. At each point they measured light intensity with a sensor and estimated the percentage cover of a moss species in three quadrats. The data are for practice. (a) Describe the relationship between light intensity and moss cover. [2] (b) Suggest one abiotic variable other than light that could have changed along the transect and affected moss cover. [1] (c) Evaluate the conclusion that low light intensity causes the moss to grow. [2]

Light intensity and moss cover along a woodland transect (practice data)

Distance from edge / m	Light intensity / lux	Mean moss cover / %
0	12000	2
5	6500	8
10	3000	21
15	1400	34
20	900	38

[3 marks]

[illegible]

[7 marks]

[illegible]

Spec B4.2

[1 mark]

A. ☐ Obligate aerobe
B. ☐ Facultative anaerobe
C. ☐ Obligate anaerobe
D. ☐ Facultative mixotroph

[1 mark]

A. ☐ Saprotrophs are autotrophic, whereas holozoic organisms are heterotrophic

B. ☐ Saprotrophs digest food outside their cells, whereas holozoic organisms digest food internally

C. ☐ Saprotrophs ingest food, whereas holozoic organisms absorb food directly

D. ☐ Saprotrophs feed on living organisms, whereas holozoic organisms feed only on dead matter

10 PAPER 1A STYLE

[1 mark]

Which forest plant starts life on the branch of a tree and later sends roots down to the soil that enclose the host trunk?

- A. ☐ Liana
- B. ☐ Strangler epiphyte
- C. ☐ Shade-tolerant herb
- D. ☐ Canopy tree

11 PAPER 2A STYLE

[3 marks]

Euglena is a freshwater protist that contains chloroplasts. Outline why *Euglena* is described as a facultative mixotroph.

12 PAPER 2A STYLE

[3 marks]

A skull of *Paranthropus robustus* has a sagittal crest and very large molars with thick enamel. Deduce the diet of this species, giving reasons.

13

[5 marks]

Two species of *Paramecium*, A and B, which feed on the same bacteria, were grown in separate cultures and then together in a mixed culture. The data are for practice. (a) Calculate the percentage decrease in the population of species B in the mixed culture compared with the separate culture on day 16. [2] (b) Explain the results of the mixed culture with reference to competitive exclusion. [3]

Population density of two Paramecium species (practice data)				
Day	A alone / cells per cm ³	B alone / cells per cm ³	A in mixed culture / cells per cm ³	B in mixed culture / cells per cm ³
0	2	2	2	2
4	60	40	50	30
8	190	120	150	40
12	200	130	180	15
16	200	125	195	5

Answer =

[illegible]

14

[3 marks]

Distinguish between the fundamental niche and the realized niche of a species.

Describe adaptations of herbivores for feeding on plants and of plants for resisting herbivory, and outline chemical, physical and behavioural adaptations of prey animals for resisting predation.

[illegible]

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 (A describes a niche, C a community, D a range of tolerance) [1]

2. [1]

C C [1]

3. [1]

A A [1]

4. [4]

- named species, e.g. red mangrove / *Rhizophora mangle* [1]
- stilt / prop roots anchor tree in soft mud [1]
- lenticels in aerial roots allow oxygen uptake / gas exchange [1]
- because waterlogged mud is anoxic / low in oxygen [1]
- roots exclude salt during water uptake [1]
- salt accumulated in older leaves that are shed [1]
- viviparous seeds / propagules germinate on parent and float to establish in mud [1]
- thick waxy leaves reduce water loss OWTTE [1]
- max 4

5. [5]

- (a) negative correlation / moss cover increases as light intensity decreases [1]
- (a) use of data, e.g. 2% at 12000 lux rising to 38% at 900 lux / change levels off at low light [1]
- (b) soil / air humidity OR soil moisture OR temperature OR soil pH [1]
- (c) correlation does not prove causation [1]
- (c) other variables such as humidity also change with distance / were not controlled [1]
- (c) only one transect / three quadrats per point, so limited replication [1]
- (c) moss may tolerate shade rather than need it / may be outcompeted in bright light OWTTE [1]
- max 5

6. [3]

- for a given temperature and rainfall pattern one natural ecosystem type / biome is likely to develop [1]
- tropical forest where temperature is high all year and rainfall very high [1]
- hot desert where rainfall is very low and daytime temperatures are high [1]
- tundra where temperatures are very low / below 0 °C most of the year and precipitation is low [1]
- accept other correct biome-climate pairs: taiga, temperate forest, grassland [1]
- max 3

7. [7]

- desert plant named, e.g. saguaro cactus / *Carnegiea gigantea* [1]
- leaves reduced to spines reduce surface area for water loss / deter herbivores [1]
- stem stores water / pleated stem swells after rain [1]
- shallow, widespread roots absorb rain quickly [1]
- CAM photosynthesis / stomata open at night, reducing water loss [1]
- desert animal named, e.g. dromedary camel [1]
- body temperature allowed to rise during day, so less water used for sweating [1]
- concentrated urine / dry faeces reduce water loss [1]
- rainforest plant named, e.g. kapok / *Ceiba pentandra* [1]
- tall / emergent trunk reaches light above canopy OR buttress roots support tree in shallow soil [1]
- leaves with drip tips shed rainwater quickly [1]
- rainforest animal named, e.g. spider monkey with prehensile tail for moving in canopy / poison frog with toxins and warning colours [1]
- Note: credit adaptations only when linked to a named species; accept common or scientific names
- max 7

8. [1]

C C [1]

9. [1]

B B [1]

10. [1]

B B [1]

11. [3]

- mixotroph: both autotrophic and heterotrophic [1]
- photosynthesises / autotrophic in light, using chloroplasts [1]
- takes in / absorbs carbon compounds from surroundings (heterotrophic) [1]
- facultative: can survive using one mode alone, e.g. heterotrophically in the dark [1]
- max 3

12. [3]

- herbivorous / tough, hard plant material, e.g. seeds, roots, tubers [1]
- large flat molars give large surface area for grinding [1]
- thick enamel resists wear from hard / abrasive food [1]
- sagittal crest anchors large jaw / temporalis muscles for powerful chewing [1]
- max 3

13. [5]

- (a) $(125 - 5) \div 125 \times 100$ [1]
- (a) = 96% [1]
- (b) both species occupy the same niche / compete for the same food [1]
- (b) species A is the better competitor / uses the bacteria more efficiently [1]
- (b) species B is eliminated / declines towards extinction in mixed culture [1]
- (b) two species cannot share the same niche indefinitely / competitive exclusion [1]
- (b) species A reaches similar density in mixed culture as alone, so is little affected [1]
- max 5; ECF in (a)

14. [3]

- fundamental niche is the potential niche based on adaptations / tolerance limits [1]
- realized niche is the actual extent of the niche when in competition with other species [1]
- realized niche is usually smaller than / part of the fundamental niche [1]
- example, e.g. barnacle *Chthamalus* restricted to upper shore by competition from *Semibalanus* [1]
- max 3

15. [8]

- chewing mouthparts / mandibles in leaf-eating insects, e.g. caterpillars, bite and grind leaves [1]
- piercing mouthparts / stylets of insects, e.g. aphids, reach phloem sap [1]
- plants have thorns / spines / physical structures that deter herbivores [1]
- plants produce toxic secondary compounds in seeds and leaves [1]
- named toxin, e.g. alkaloids / nicotine / cyanogenic glycosides [1]
- some herbivores have metabolic adaptations to detoxify the toxins, e.g. koala / eucalyptus [1]
- prey chemical adaptation, e.g. toxins / distasteful chemicals / defensive sprays [1]
- prey physical adaptation, e.g. camouflage / spines / shells / speed [1]
- warning colours advertise toxicity, so predators learn to avoid prey [1]
- prey behavioural adaptation, e.g. herding / shoaling / alarm calls / fleeing / playing dead [1]
- max 8