NAME _____ CLASS _____ DATE _____

IB BIOLOGY · B4.2

Ecological niches

Notes to fill in alongside the guide. Each numbered block matches a chapter of the guide, and of the lesson slides. Write in the gaps, answer the cues, annotate the figures, and sum up each section in your own words.

BY THE END YOU CAN

- [ ] Describe the ecological niche of a species as its role, with its biotic and abiotic interactions B4.2.1
- [ ] Distinguish obligate anaerobes, facultative anaerobes and obligate aerobes by their tolerance of oxygen B4.2.2
- [ ] Outline photosynthesis as the mode of nutrition of plants, algae and some prokaryotes B4.2.3
- [ ] Describe holozoic nutrition: ingestion, digestion, absorption and assimilation B4.2.4
- [ ] Explain mixotrophic nutrition in protists such as Euglena, obligate and facultative B4.2.5
- [ ] Explain how saprotrophic fungi and bacteria feed, and their role as decomposers B4.2.6
- [ ] Outline the three energy sources archaea use to make ATP B4.2.7
- [ ] Infer the diet of hominids from the features of their teeth and skulls B4.2.8
- [ ] Describe adaptations of herbivores for eating plants, and of plants for resisting them B4.2.9
- [ ] Describe chemical, physical and behavioural adaptations of predators and their prey B4.2.10
- [ ] Explain how forest plants reach light: canopy trees, lianas, epiphytes, stranglers and shade plants B4.2.11
- [ ] Distinguish a fundamental niche from a realized niche, with barnacles on a rocky shore B4.2.12
- [ ] Explain competitive exclusion, and the two outcomes of competition between species B4.2.13

01 A habitat is an address; a niche is a job

B4.2.1

CUES

Predict: Two species of bird live in the same oak wood. Which statement must be true?

What is meant by ecological niche?

NOTES

1 The _____ of a species is its role in the ecosystem: where it lives, when it is active, what it eats and how it gets it, what eats it, what it competes with, and the range of temperature, salinity or light it can stand.

2 Some of these are _____ interactions, with other living things.

3 Others are _____, with the physical and chemical conditions.

4 Niche: the _____ of a species in its ecosystem.

5 It includes _____ interactions (food, predators, competitors, parasites, mutualists) and _____ ones (temperature, water, light, oxygen).

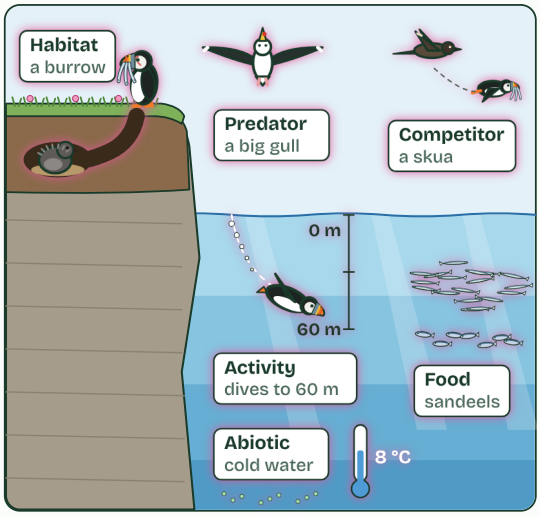
6 Both affect its _____.

7 The habitat is only _____ it lives; the niche is how it lives there.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: habitat, predator, interactions, activity, food, abiotic factors.



REMEMBER IT

What goes into a niche

H	A	R	I
Hungry	Ants	Raid	Insects
H	A	R	I

SUMMARY

Sum up section 01 in two or three sentences of your own.

02 Oxygen: needed, optional or poison

B4.2.2

CUES

Predict: A bacterium grows all the way down a tube of broth, but most thickly near the top. Which is it?

What is meant by obligate aerobes?

What is meant by facultative anaerobes?

What is meant by obligate anaerobes?

NOTES

1 Oxygen is one abiotic factor that splits microbes into three groups. _____ need it: they respire aerobically and cannot make enough ATP without it. *Mycobacterium tuberculosis* is one, which is why tuberculosis grows best in the well-aired lungs.

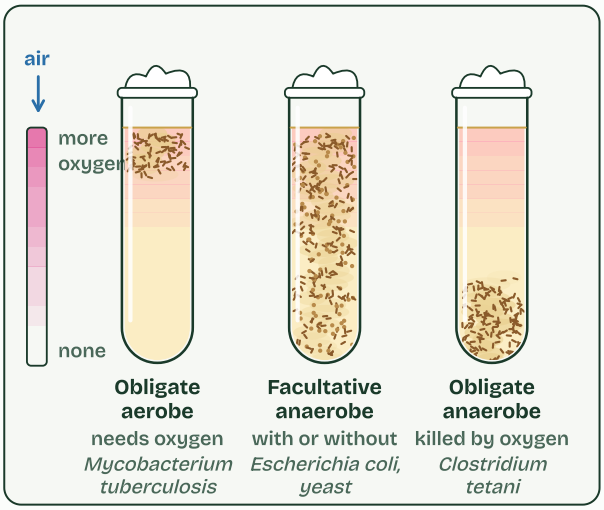
2 _____ use oxygen when it is there and switch to anaerobic respiration when it is not, though they grow faster with it.

3 Yeast (*Saccharomyces cerevisiae*) and *Escherichia coli* in your gut are both facultative. _____ are poisoned by oxygen: they lack the enzymes that break down the reactive forms of oxygen, which damage their cells. *Clostridium tetani*, which causes tetanus, lives in soil and grows only in deep, closed wounds.

Your own notes

ANNOTATE THE FIGURE

Label the key parts and add a note on what it shows.



SUMMARY

Sum up section 02 in two or three sentences of your own.

03 Making food from light

B4.2.3

CUES

Predict: Why are photosynthetic organisms called producers in a food chain?

What is meant by autotroph?

NOTES

1 An _____ makes its own carbon compounds from carbon dioxide and other simple inorganic substances.

2 Most do it by _____: light energy, captured by pigments such as chlorophyll, is used to make glucose from carbon dioxide and water, and oxygen is given off.

3 Photosynthesis feeds three groups: _____, _____ (from single cells such as *Chlamydomonas* to the filaments of *Spirogyra* and the giant kelps) and several groups of _____.

4 The best known are the _____, such as *Anabaena*: they have no chloroplasts, but their chlorophyll sits on folded membranes in the cytoplasm.

5 _____: makes its own carbon compounds from inorganic ones.

6 _____: light energy used to make glucose from carbon dioxide and water; oxygen released.

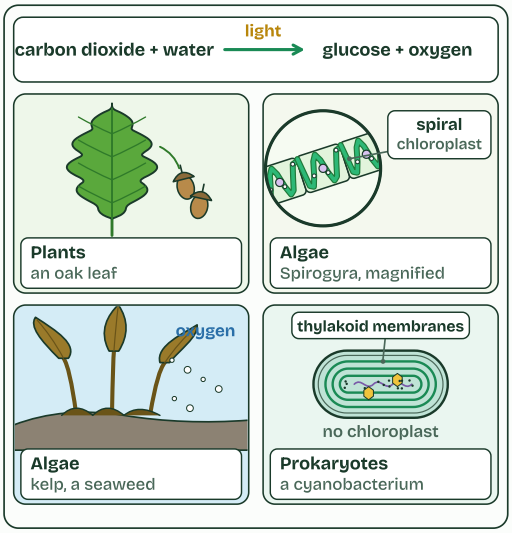
7 Done by _____, _____ and some _____, such as cyanobacteria.

8 Prokaryotes photosynthesise _____.

Your own notes

ANNOTATE THE FIGURE

Label the key parts and add a note on what it shows.



SUMMARY

Sum up section 03 in two or three sentences of your own.

04 Swallow it, then break it down

B4.2.4

CUES

Predict: A Hydra catches a water flea with its tentacles, pushes it through its mouth and digests it in its body cavity. Which step of holozoic nutrition is the pushing through the mouth?

What is meant by heterotroph?

What is meant by holozoic nutrition?

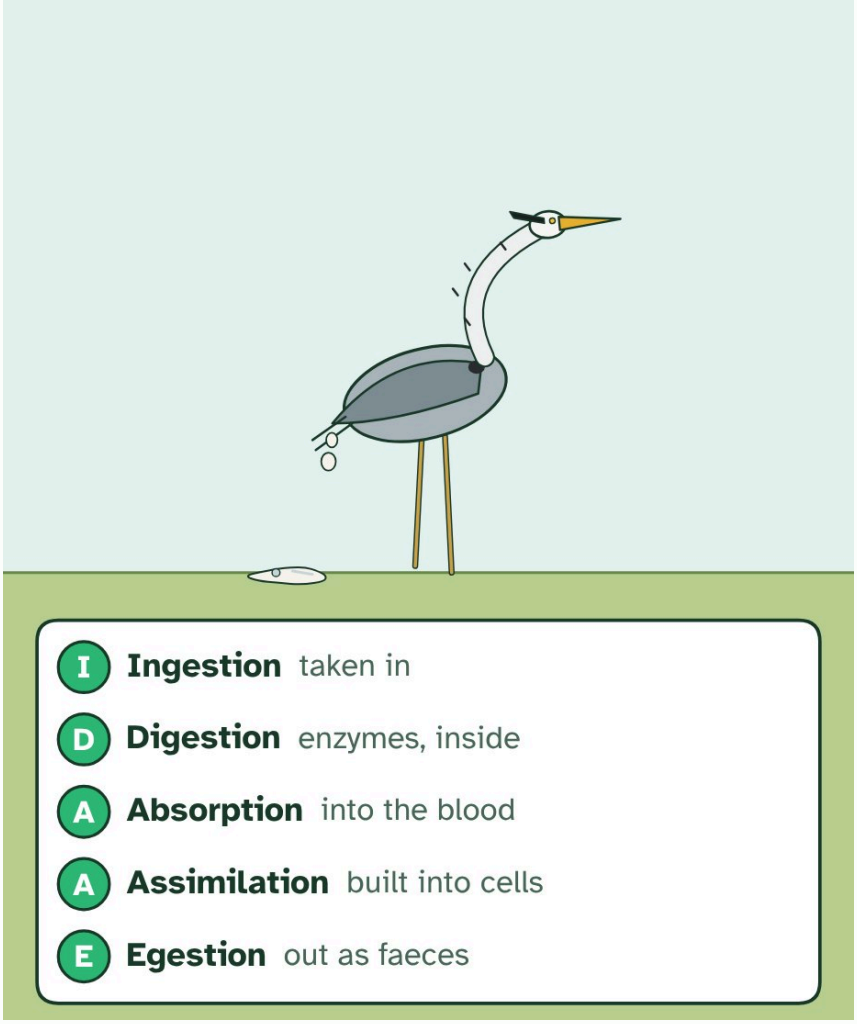
NOTES

1. Every animal is a _____: it gets its carbon compounds ready-made from other organisms.
2. Animals do it by _____.
3. Food is taken into the body whole or in pieces (_____), broken down inside the gut by enzymes into small soluble molecules (_____), taken across the gut wall into the blood or cells (_____), and used to build the animal's own molecules and tissues (_____).
4. Whatever cannot be digested passes out of the gut as faeces (_____).

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (From mouth to cell): what is happening, and why?



REMEMBER IT

The order of holozoic nutrition

I	D	A	A	E
I	Despise	All	Algebra	Exams
I	D	A	A	E

SUMMARY

Sum up section 04 in two or three sentences of your own.

05 Both at once

B4.2.5

CUES

Predict: A protist in a lake photosynthesises in the light and eats bacteria. Grown in the light with no bacteria, it dies. What kind of nutrition does it have?

What is meant by mixotroph?

NOTES

1 A _____ can feed both ways: as an autotroph and as a heterotroph. *Euglena gracilis*, a single-celled protist of ponds and ditches, has chloroplasts and photosynthesises in the light, swimming towards it with its flagellum and steering with a red eyespot.

2 Euglena is a _____ mixotroph: it can live by either mode alone, and uses both when it can. _____ mixotrophs need both to grow.

3 _____: both autotrophic and heterotrophic.

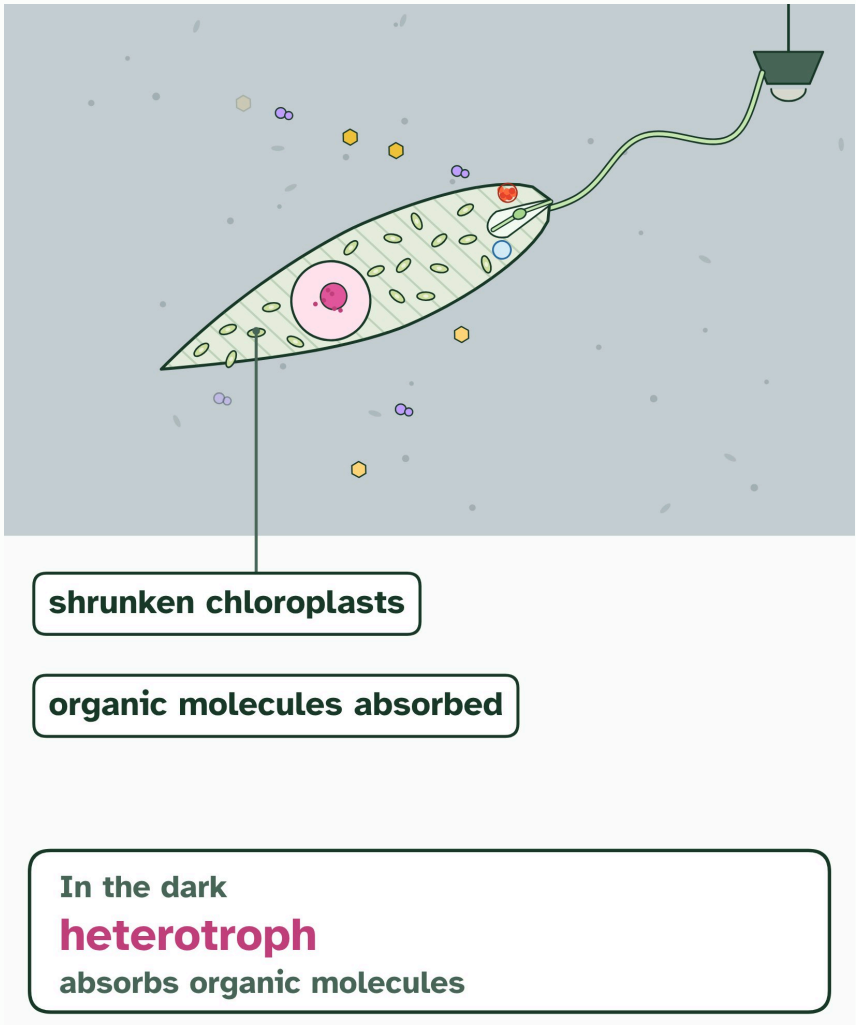
4 _____ mixotroph: can live by either mode alone.

5 _____ mixotroph: needs both modes to grow; common in ocean plankton.

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (Euglena, light and dark): what is happening, and why?



SUMMARY

Sum up section 05 in two or three sentences of your own.

06 Digesting from the outside

B4.2.6

CUES

Predict: What is the main difference between how a fungus and how an animal digests its food?

What is meant by saprotroph?

What is meant by decomposers?

NOTES

1 A _____ lives on dead organic matter: fallen leaves, dead wood, dung, corpses.

2 Instead it secretes digestive enzymes onto the food, which digest it outside the body, and then absorbs the small, soluble products. This is _____.

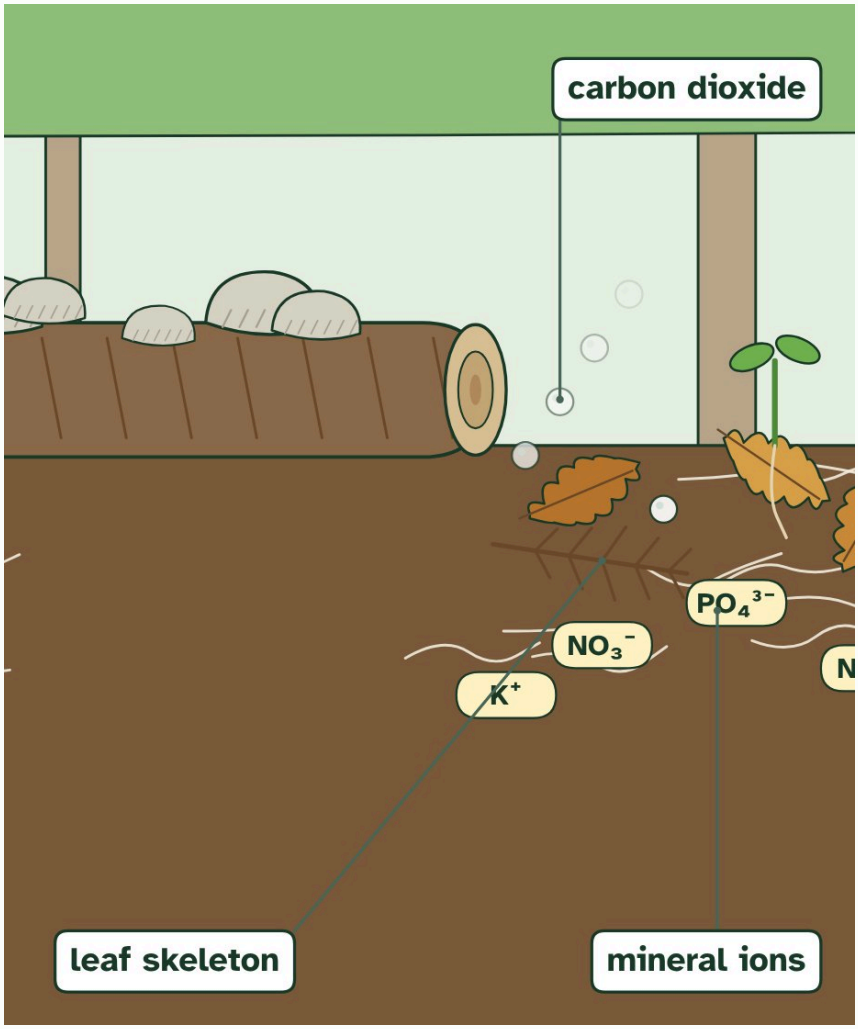
3 A fungus such as the oyster mushroom (*Pleurotus ostreatus*) grows through a dead log as a mesh of thin threads, the _____, which give a huge surface for secreting and absorbing; the mushroom is only its fruiting body.

4 Together these _____ release the nutrients locked in dead matter, such as nitrogen, phosphorus and carbon dioxide, so that producers can use them again.

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (Digesting from the outside): what is happening, and why?



SUMMARY

Sum up section 06 in two or three sentences of your own.

07 The third domain, and its three fuels

B4.2.7

CUES

Predict: An archaean lives in a hot spring rich in hydrogen sulfide, in complete darkness, with almost no organic matter. Where does its energy most likely come from?

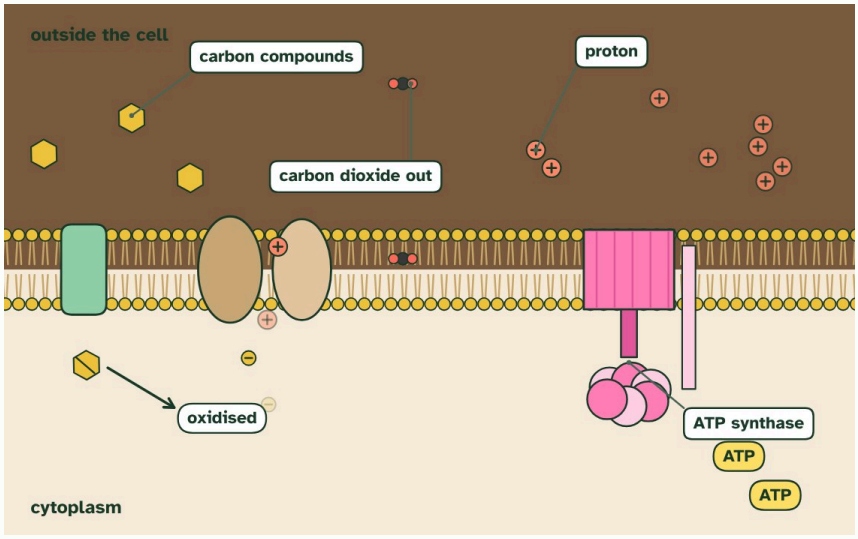
NOTES

1 Living things fall into three domains: _____, _____ and _____.

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (Three ways to power a cell): what is happening, and why?



SUMMARY

Sum up section 07 in two or three sentences of your own.

08 Reading a diet in the teeth

B4.2.8

CUES

Predict: A fossil hominid skull has a sagittal crest and molars four times the area of a modern human's. What do these suggest?

NOTES

1 Watching living mammals, biologists built a theory: _____ have broad, flat, thickly enamelled molars for grinding tough plants, and big jaw muscles; _____ have sharp teeth for slicing; _____ have a mix.

2 From that theory, the diet of an extinct species can be _____ from its teeth and skull.

3 *Paranthropus robustus*, from South Africa about 2 to 1 million years ago, had small front teeth but enormous premolars and molars with very thick enamel, a deep, heavy jaw, wide cheekbones and a bony crest along the top of the skull, the _____, where huge chewing muscles attached.

4 It ground tough plant food: seeds, nuts, roots and tubers. *Homo sapiens* has small molars, small canines and no crest: the teeth of an _____ that cuts its food with tools and cooks it. *Homo floresiensis*, the small hominid of the island of Flores, Indonesia, had teeth like ours in shape, and its cave holds stone tools and the bones of young pygmy elephants (*Stegodon*): an omnivore too.

5 _____ features: large, flat molars and premolars, thick enamel, heavy jaw, sagittal crest.

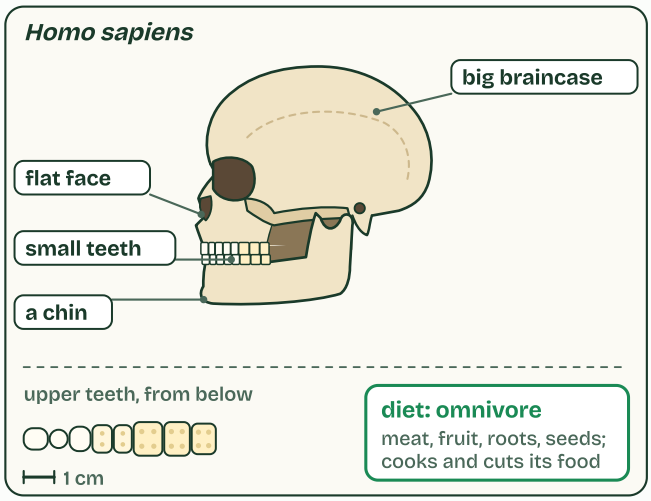
6 _____ features: smaller molars, varied teeth for biting and grinding, no crest.

7 _____: theory from living mammals lets us _____ the diet of extinct ones.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as H. sapiens, H. floresiensis and P. robustus. Note what changes each time.



SUMMARY

Sum up section 08 in two or three sentences of your own.

09 An arms race over leaves

B4.2.9

CUES

Predict: Why does a plant store toxins in its seeds as well as its leaves?

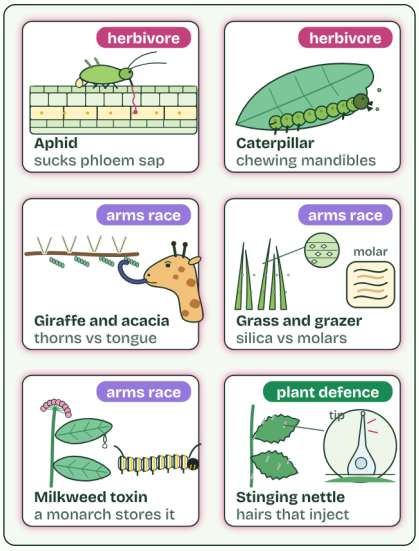
NOTES

1. A caterpillar's _____ are a pair of hard mandibles that cut and crush leaf tissue.
2. An aphid's _____ are a fine, flexible stylet that slips between plant cells into a phloem tube and drinks the sugary sap.
3. Plants resist with _____ defences: thorns on acacias, spines on cacti, stinging hairs on nettles, and leaves toughened with silica in grasses.
4. They also make _____, often stored in seeds and leaves: nicotine in tobacco, caffeine in coffee and tea, cyanide-releasing compounds in cassava, and cardenolides, which stop the heart, in milkweeds.
5. Some herbivores have _____ that detoxify or survive the toxins.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: piercing mouthparts, chewing mouthparts, thorns and a long tongue, silica and ridged teeth, toxic secondary compounds, stinging hairs.



SUMMARY

Sum up section 09 in two or three sentences of your own.

10 Hunters and the hunted

B4.2.10

CUES

Predict: A monarch butterfly stores milkweed toxins and is brightly coloured. Is this a chemical, physical or behavioural adaptation against predators?

NOTES

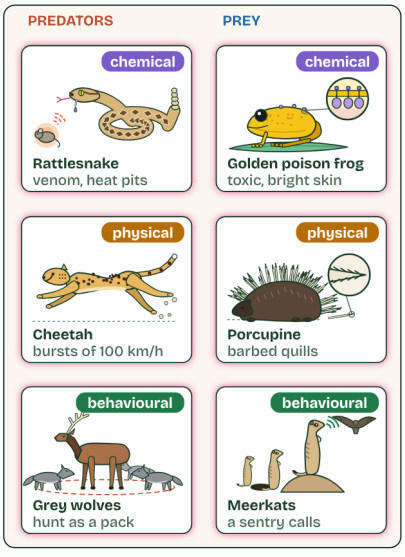
1 A predator must _____, _____ and _____ its prey, and each step has its adaptations.

2 Each can be _____, _____ (a structure) or _____.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: rattlesnake, golden poison frog, cheetah, porcupine, wolves, meerkats.



SUMMARY

Sum up section 10 in two or three sentences of your own.

11 Racing for the light

B4.2.11

CUES

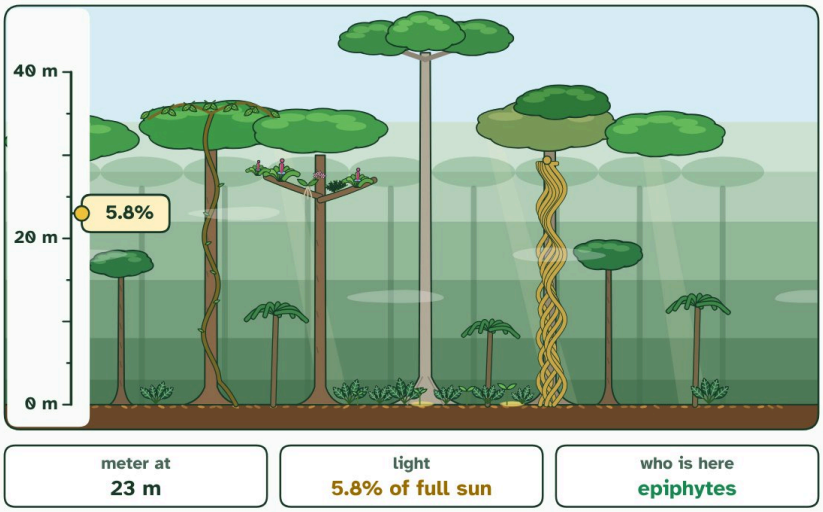
Predict: Why does a liana not need a thick trunk of its own?

NOTES

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (Racing for the light): what is happening, and why?



REMEMBER IT

Five ways to reach the light

C	L	E	S	H
Can	Little	Elves	Steal	Herbs
C	L	E	S	H

SUMMARY

Sum up section 11 in two or three sentences of your own.

12 Where it could live, and where it does

B4.2.12

CUES

Predict: What sets the upper limit of Chthamalus on the shore?

What is meant by fundamental niche?

What is meant by realized niche?

NOTES

1 The _____ of a species is everything it could do and everywhere it could live, set by its adaptations and its tolerance limits, if no other species got in its way.

2 The _____ is what it actually does and where it actually lives, when it competes with other species.

3 _____: the potential niche, from adaptations and tolerance limits.

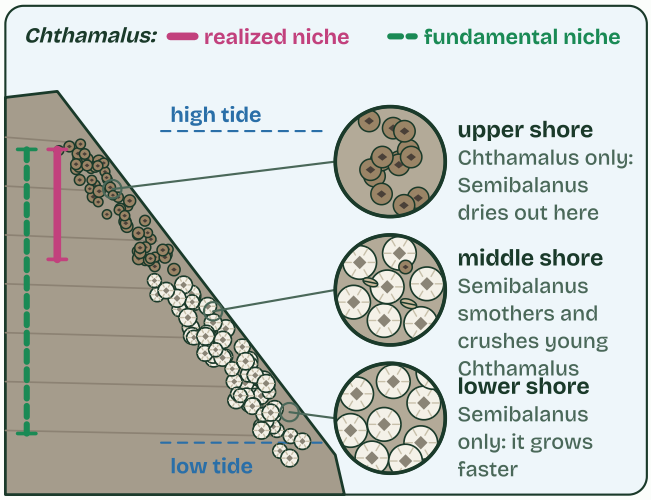
4 _____: the actual niche, with competition from other species.

5 The realized niche is _____ the fundamental niche.

Your own notes

ANNOTATE THE FIGURE

Label the key parts and add a note on what it shows.



SUMMARY

Sum up section 12 in two or three sentences of your own.

13 No two species can share a niche

B4.2.13

CUES

Predict: Two species of Paramecium are grown together and both survive for months. What is the most likely reason?

What is meant by competitive exclusion principle?

NOTES

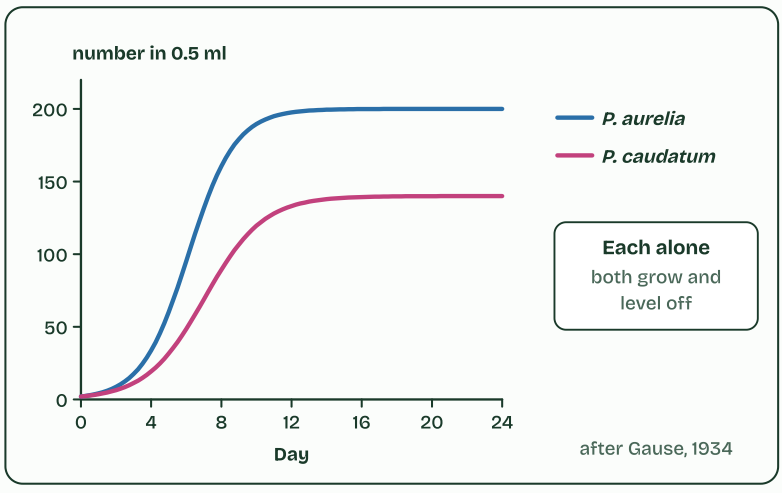
1 If their niches are the same, one will always be a little better at getting the resource, or reproduce a little faster, and in time it removes the other from that place. This is the _____.

2 It explains why every species' niche is _____.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Each alone, Aurelia with caudatum and Caudatum with bursaria. Note what changes each time.



SUMMARY

Sum up section 13 in two or three sentences of your own.

Check yourself

The check for this guide is online: a fresh paper of past-paper style questions from the exam bank on B4.2 each time, marked as you go, and saved to your Exam practice progress when you are signed in. Scan the code, or type the link.

biologybybradford.com/exam-maker/sit?topics=B4.2&level=SL&paper=quiz&marks=15&src=ep

How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.