

Plus, Minus, Zero: Sorting Interactions by Who Gains and Who Loses

Learning target: I can use the terms predation, competition, mutualism, commensalism and parasitism to classify new interactions by their effect on each partner, and explain how the terms relate to one another.

Vocabulary in action

About 35 min

Individual

MS-LS2-2 · practice

independent practice

writing

visual modeling

Standards connections

MS-LS2-2 (practice): Classifying unfamiliar interactions by their effect on each partner is the vocabulary and reasoning students need before they can explain why the same patterns of interaction appear in ecosystem after ecosystem.

Purpose: build · **Time:** about 35 minutes · **Format:** individual

Answers with reasoning

predation

A feeding interaction: the predator gets its food by eating all or part of another living thing, the prey. In this lesson, eating plants counts, so a grazing animal is a predator of grass.

carnivore

A predator whose diet is mostly animals.

herbivore

A predator whose diet is mostly plants or plant parts.

omnivore

A predator that regularly eats both plants and animals. The mix does not have to be equal; some omnivores eat mostly plants.

competition

An interaction in which two organisms or species need the same limited resource, so each gets less than it would alone. Both are harmed.

mutualism

An interaction in which each of the two species gains something that helps it survive, grow or reproduce.

commensalism

An interaction in which one species gains and the other is neither helped nor harmed, as far as scientists can tell.

parasitism

An interaction in which one species (the parasite) lives on or in another (the host) and takes resources from it a little at a time, usually weakening the host rather than killing it.

Part A: Crack the symbol code

Effect of each interaction on the two partners

Interaction	Partner 1	Partner 2
Mutualism	+	+
Commensalism	+	?
Predation	+ (predator)	– (prey)
Parasitism	? (parasite)	– (host)
Competition	?	?

Three of the five rows are complete. The question marks are for you to fill in using the word bank.

1. Fill the question marks. Commensalism: partner 2 is _____. Parasitism: the parasite is _____. Competition: partner 1 is _____ and partner 2 is _____.

Answer: Commensalism: partner 2 is 0 (no effect). Parasitism: the parasite is + (helped). Competition: partner 1 is – and partner 2 is –.

Why: These follow directly from the word bank definitions: commensalism helps one and leaves the other unaffected; a parasite gains at the host's expense; competitors both get less.

Also acceptable: Accept 'unaffected' for 0 and 'harmed' for –.

2. Predation and parasitism have the same symbols (+ and –). Using the word bank, explain two differences that tell them apart.

Answer: Difference 1: a predator eats all or part of its prey in one event, while a parasite stays on or inside its host and takes resources a little at a time. Difference 2: a hunting predator usually kills its prey, while a parasite usually weakens the host without killing it.

Why: Both differences are in the word bank. A third acceptable difference is size: parasites are usually much smaller than their hosts.

Also acceptable: Accept 'parasites are tiny compared with hosts; predators are often bigger than prey' as one of the two differences.

- Where the organism lives or how it feeds (on or in the host versus eating the prey)
- Usually kills versus usually weakens

3. Which interaction is the only one in which **neither** partner gains? Explain why it still counts as an interaction even though nobody benefits.

Answer: Competition. It counts as an interaction because each species changes what happens to the other: because both need the same scarce resource, each one's presence leaves less for the other, so both populations are affected even though neither gains.

Why: Students sometimes think an interaction must involve a winner; competition shows that an interaction is any effect of one species on another.

Also acceptable: Accept 'both are harmed, so both are affected, and being affected is what makes it an interaction.'

- Names competition
- Explains that each species affects the other even without a winner

Part B: Which term fits?

Read each situation. Decide the effect on the first-named species and on the second-named species, then name the interaction. **Situation 1.** A mistletoe plant sinks root-like structures into the branch of an oak and draws off water and minerals; the branch beyond the mistletoe often weakens, but the oak lives for years.

Situation 2. A great blue heron stands in the shallows and swallows a frog. **Situation 3.** Two kinds of hummingbird visit the same patch of flowers; when both are present, each bird gets less nectar than it would alone. **Situation 4.** Bees collecting nectar carry pollen between squash flowers; the squash plants set fruit and the bees get food. **Situation 5.** A songbird builds its nest in the fork of a maple's branches; the maple is neither helped nor harmed as far as scientists can tell. **Situation 6.** A deer browses the new shoots of a shrub, leaving the shrub alive but smaller. **Situation 7.** A tapeworm lives in a dog's intestine and absorbs food the dog has digested; the dog loses weight. **Situation 8.** Microbes in a cow's stomach break down grass fibers the cow cannot digest on its own; the microbes get food and a warm home, and the cow gets nutrients from the grass. **Situation 9.** Two shrub species on a dry hillside need the same scarce soil water; both grow more slowly when planted together than apart. **Situation 10.** A hermit crab moves into the empty shell of a snail that died months ago.

4. Complete the table for situations 1 to 9.

Answer: 1: mistletoe +, oak –, parasitism. 2: heron +, frog –, predation. 3: hummingbird A –, hummingbird B –, competition. 4: bees +, squash +, mutualism. 5: songbird +, maple 0, commensalism. 6: deer +, shrub –, predation (the deer is an herbivore; in this lesson plant-eating is predation). 7: tapeworm +, dog –, parasitism. 8: microbes +, cow +, mutualism. 9: shrub A –, shrub B –, competition.

Why: Each situation was written so that the symbols can be read from the sentence. Situation 1 and 7 are parasitism because the gainer lives on or inside a living partner and takes a little at a time; 2 and 6 are predation because the gainer eats part or all of the other.

Also acceptable: For situation 6, accept 'herbivory' written next to 'predation' if the student notes that this lesson treats plant-eating as predation. A student who labels situation 1 'predation' should be shown the word 'lives on' in the sentence.

5. Situation 10 is left out of the table on purpose. Explain why it is **not** an interaction between two species in the sense this lesson uses.

Answer: The snail is already dead, so the crab is using an object, not interacting with a living organism. Interactions in this lesson are between living things that affect each other's survival, growth or reproduction; an empty shell cannot be helped or harmed.

Why: This item checks that students apply the definition rather than pattern-matching 'crab uses shell' to commensalism.

Also acceptable: Accept 'the snail cannot be affected because it is not alive.'

- Says the snail is dead or the shell is not a living organism
- Links that to the meaning of interaction

6. Situations 2 and 6 get the same name even though the frog dies and the shrub does not. Explain why, and say which one is easier to predict the effect of on the prey population.

Answer: Both are predation because in each case one organism gets food by eating all or part of another: the heron eats the whole frog; the deer eats part of the shrub. The heron-frog case is easier to predict because every meal removes one prey organism from the population. The deer leaves the shrub alive, so how much browsing the shrub population can take before it shrinks is harder to know.

Why: This is the lesson's own distinction: carnivores usually kill, so their effect on prey numbers is predictable; herbivores often do not, so their effect is harder to predict.

Also acceptable: Accept 'the frog dies, so you can count the loss' as the reason.

- Both labeled predation with the eating-for-food reason
- Identifies the heron-frog case as easier to predict and says why

7. A classmate says, 'Herbivore is the opposite of predator.' Use the word bank to explain why that is wrong in this lesson, and give the three words that are the real sub-groups of predator.

Answer: In this lesson a predator is any organism that gets food by eating another organism, including plants, so an herbivore is a kind of predator, not its opposite. The three sub-groups of predator are carnivore (mostly animals), herbivore (mostly plants) and omnivore (both).

Why: The lesson uses the broad meaning of predator; students may meet the narrower 'hunter' meaning elsewhere, which is why the question says 'in this lesson'.

Also acceptable: A student who says 'in everyday talk predator means hunter, but scientists in this lesson include plant eaters' is giving a complete answer.

- States that herbivores are a type of predator here
- Lists carnivore, herbivore, omnivore

8. A black bear's diet is mostly berries, nuts and roots, with some fish and insects. Is it a carnivore, herbivore or omnivore? Explain using the word bank definition.

Answer: Omnivore. The word bank says an omnivore regularly eats both plants and animals and that the mix does not have to be equal. The bear eats mostly plant food but regularly eats fish and insects too, so it is an omnivore, not an herbivore.

Why: This corrects the idea that omnivores must eat plants and animals in similar amounts; what matters is that both are a regular part of the diet.

Also acceptable: None; 'herbivore because it is mostly plants' misreads the definition.

- Omnivore
- Reason refers to eating both regularly, not to equal amounts

Part C: Build the map

9. Draw a concept map with 'Interactions between species' in the center and five branches, one per interaction. On each branch write the two symbols and one example from Part B. Then draw one extra line connecting the two branches that are most alike and write on it what they share.

Answer: A map with the center label, five branches (mutualism + +, commensalism + 0, predation + –, parasitism + –, competition – –), one correct Part B example on each, and an extra link joining predation and parasitism labeled with what they share (same symbols; one gains, the other is harmed).

Why: The extra link is the thinking step: predation and parasitism are the two branches that share a symbol pair.

Also acceptable: A student who links mutualism and commensalism (both have a + for partner 1) has found a real similarity; give credit if the label is accurate.

- Five branches with correct symbols
- A correct example on each branch
- Link between predation and parasitism with a correct shared feature

10. The word **host** and the word **prey** both name the partner that is harmed. Write one sentence that uses both words correctly and shows the difference between them.

Answer: Example: 'A flea's host is the dog it lives on and bites, while an owl's prey is the mouse it catches and eats.' The sentence should show that a host is the living partner that a parasite lives on or inside, while prey is eaten by a predator.

Why: Using both words in one accurate sentence shows the student can tell the roles apart.

Also acceptable: Any accurate pair of examples is acceptable.

- Host paired with a parasite that lives on or in it
- Prey paired with a predator that eats it

Teacher notes

The word bank definitions deliberately improve on two textbook simplifications: an omnivore does not need a 'similar amounts' diet, and herbivory is counted as predation only 'in this lesson' (many biology texts treat herbivory as its own category). Situation 5 (bird nests in a tree) and the commensalism definition say 'as far as scientists can tell' because a true zero effect is hard to prove. For the extension, oxpeckers and buffalo are a real, debated case; the point is that the label depends on measured costs and benefits, which can shift with conditions. Common error on q4: labeling mistletoe as competition because 'it takes water'; the deciding feature is that it lives on the oak and draws from it.

Scaffold offered to students: Two questions, every time

For any situation, ask only two questions. Question 1: Does the first species end up better off, worse off, or the same? Question 2: Does the second species end up better off, worse off, or the same? Write the two symbols first, then look them up in the grid. If both are minus, it is competition. If one is plus and the other is zero, it is commensalism. If one is plus and the other is minus, ask whether the gainer eats the other outright (predation) or lives on or in it and takes a little at a time (parasitism).

Extension: The partner that changes its mind

Some interactions do not sit still in one box. Oxpecker birds on African buffalo eat ticks from the buffalo's skin, which helps the buffalo, but they also peck at open wounds and drink blood, which harms it. Write a paragraph explaining which two of the five interaction names could describe oxpeckers and buffalo, what evidence a scientist would need to collect to decide which fits better, and why the answer might be different in the dry season than in the wet season.