Name: _____ Period: _____ Date: _____

Learn-Biology.com: Ecosystems HS-Level, Student Learning Guide

Getting to the tutorials.

- Go to learn-biology.com. Use the High School menu to find "Ecosystems"
- If you're submitting this electronically to your instructor, please type your answers in **blue**, **red**, or any other color your instructor suggests.
- As you go, click on or check this ❑ to change it to ☑

Tutorial 1: The Carbon Cycle

☐ 1. Read the Introduction, "Ecosystems and Biogeochemical Cycles," and complete the interactive table, "Biotic v. Abiotic Ecosystem Components."

☐ 2. Complete the "Ecology and Biogeochemical Cycles" Flashcards

Checking Mastery: From memory, write out definitions for the following terms.

Ecosystem	
Biotic	
Abiotic	
Biogeochemical cycle	

☐ 3. Read "Biogeochemical Cycle Basics," and an Introduction to the Carbon Cycle."

☐ 4. Complete the "Biogeochemical Cycles/Carbon Cycle" Flashcards and Quiz.

Capturing what you've learned. Write our definitions for the following terms.

Flow	
Reservoir	
Carbon fixation	
Producer	
Consumer	

☐ 5. Read "Death and decomposition..." and complete the interactive diagram.

☐ 6. Read "Fossil fuel formation, extraction..." and complete the interactive diagram.

Summarizing what you've learned.

a. What are decomposers? What role do they play in biogeochemical cycles?

b. Why are coal, oil, and natural gas called fossil fuels?

c. How are combustion and cellular respiration similar? How are they different?

☐ 7.Reach "The Carbon Cycle also includes Forest Fires and …"

☐ 8. Watch the Carbon Cycle Music Video, and complete the interactive Lyrics.

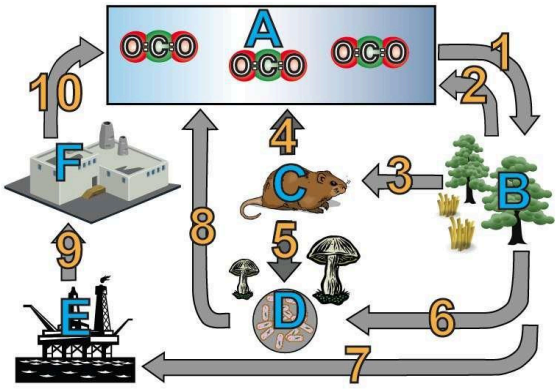
☐ 9 Take the "Carbon Cycle, Cumulative Quiz"

Checking Mastery

Task 1: Depending on its effect on atmospheric CO_2, write "increases CO_2" or "decreases CO_2 "for each of the following:

photosynthesis	
decomposition	
respiration	
combustion	
Fossil fuel formation	

Task 2: Make a key to the diagram below



A.		3.	
B.		4.	
C.		5.	
D.		6.	
E.		7.	
F.		8.	
1.		9.	
2.		10.	

Task 3: Imaginative Science Writing
Pretend that you're a carbon atom in a molecule of CO_2 up in the air. In the space below, describe how you move through the carbon cycle. Describe at least four journeys that you might take.

Tutorial 2: Food Chains and Food Webs

- ☐ 1 Read "Plants Bring Matter and Energy into Ecosystems," and complete the "Energy from Plants" flashcards.
- ☐ 2. "Animals consume the matter and energy captured by plants," and complete the "Ecological Consumers" flashcards.

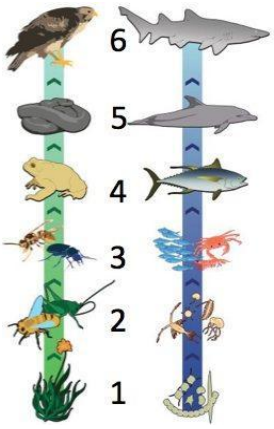
Capturing what you've learned
1. Try to define the following terms from memory. If you can't, look back to the website.

Term	Definition/Description
Ecological producer/ autotroph	
Primary consumer/ heterotroph	
Secondary consumer/ carnivore	
Tertiary/third-level consumer	

2. How are plants, algae, and cyanobacteria similar? How are they different?

- ☐ 3. Read about "Autotrophs, Heterotrophs, and "Food Chains," and take the short quiz that follows.
- ☐ 4. Read "Food Webs."
- ☐ 5. Read "Other Ways of Getting Food…"
- ☐ 6. Complete the "Food Chains, Food Webs" Flashcards.
- ☐ 7. Take the "Food Chains, Food Webs..." Quiz.

Checking Understanding: Make a key to the diagram below



Define each of the following terms

Term	Definition/Description
Food chain	
Food web	
Heterotroph	
Trophic level	
Omnivore	
Decomposer	
Scavenger	
Parasite	

Continue to the next tutorial

Tutorial 3: Trophic Levels and Energy Pyramids (introduction)
1 and 2. Read the Introduction and the "Thought Experiment..." Make your prediction: To support the largest possible crew, we should eat as ……. . My reasoning is as follows:

4. Trophic Levels and Energy Pyramids, part 2

☐ 1 and 2. Read the introduction and "The Easy Math of..." As you read, complete all the interactive questions and diagrams.

☐ 3. Complete the "Math of Trophic Levels" flashcards.

In your own words: What's the 10% rule?

☐ 4. Read "Understanding the 10% Rule." As you read, complete the quiz "The 10% rule in Action."

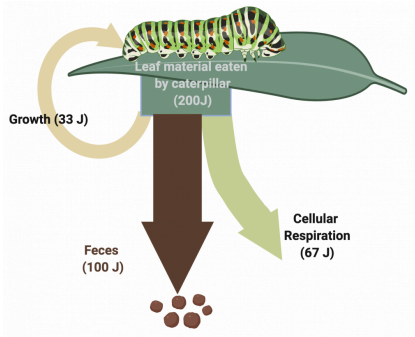
☐ 5. Complete the flashcards "Energy Transfer Between Trophic Levels"

Checking Understanding

a. What is "metabolic rent," and how does it relate to the 10% rule?

b.

c. How does the image below relate to the 10% rule?



d. What's the 3rd reason for the 10% rule?

☐ 6. Read "Other Ecological Pyramids."

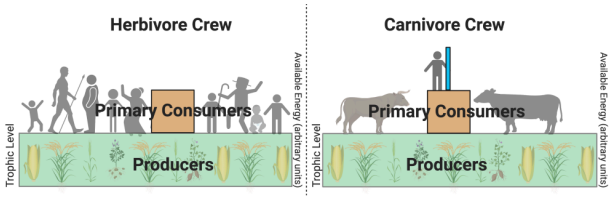
☐ 7. Take the "Ecological Pyramids" Quiz.

☐ 8. Read the "Concluding Thoughts" and watch the "Food Chain Song" music video. If you're in a classroom, use ear buds (or check with your teacher) before playing the video.

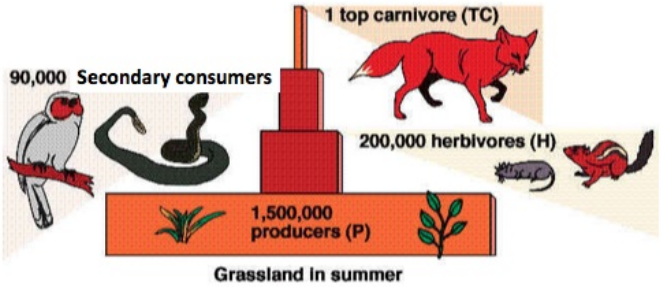
☐ 9. Complete the "Trophic Levels and Energy Pyramids" Quiz

Checking Understanding:

Task 1: With your deeper understanding of energy transfer between trophic levels, explain why on an interstellar spaceship with a fixed energy budget, you could support more herbivores than carnivores.

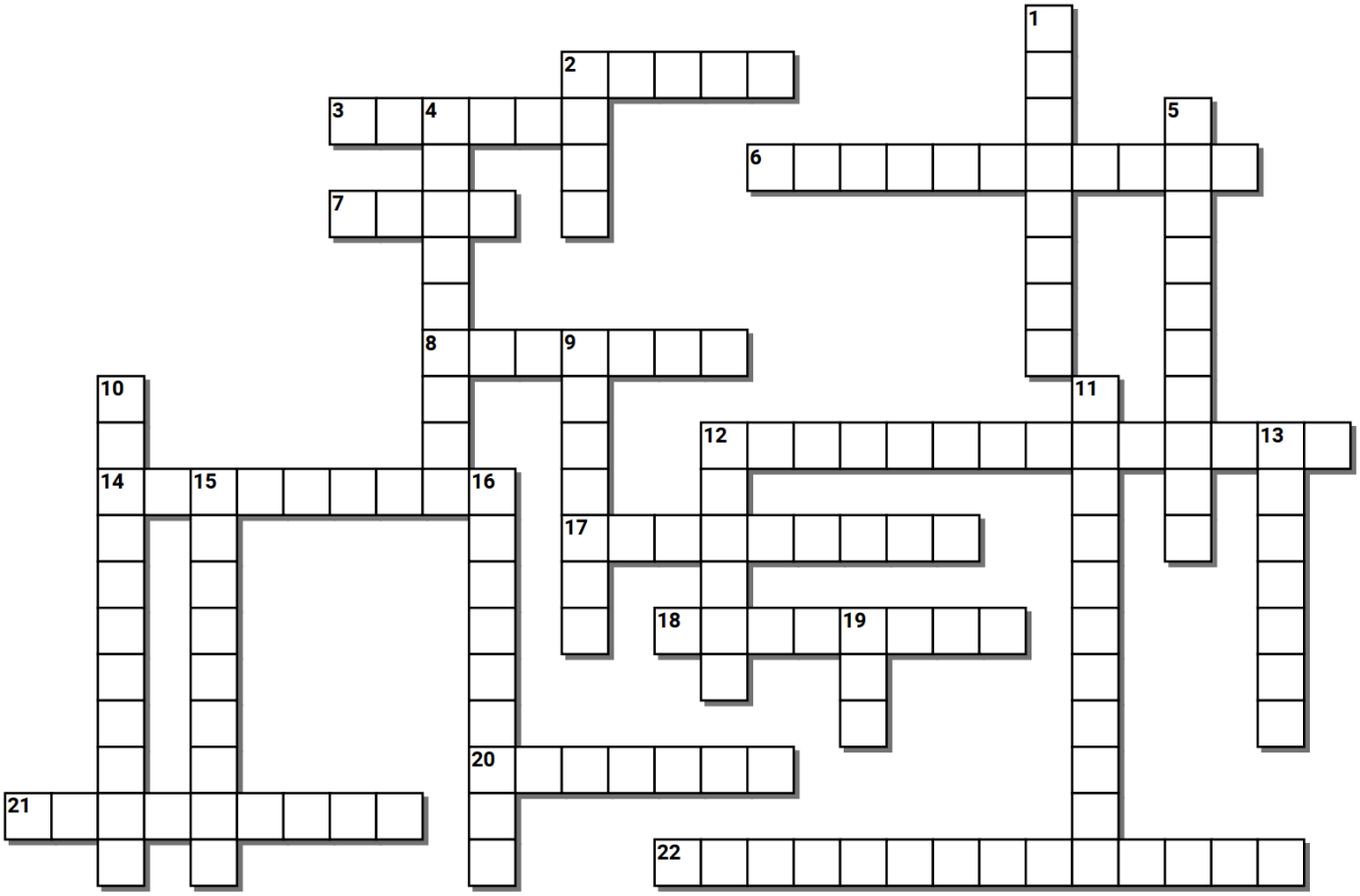


Task 2: Explain the pyramid of numbers. Include why it sometimes is not shaped like a pyramid.



Task 3: Explain the pyramid of biomass.

Ecosystems, Food Chains and Trophic Levels Crossword



Note: if you can't print this out, make a table below these clues and put your answers there.

Across:
2. Has chemical energy that's ingested but not absorbed.
3. These fuels power modern civilization
6. A process that returns CO2 to the air from living things
7. In any energy transformation, some _____ energy diffuses into the environment.
8. The pyramid of _____ shows how many organisms at each trophic level
12. A pathway through with a substance cycles through an ecosystem
14. An animal eater
17. Feeds itself
18. Carbon _____ is how plants gain mass.
20. A feeding level
21. A plant eater
22. Brings carbon into plants

Down:
1. Preys on a living (and usually much larger) host
2. How a substance in a cycle moves
4. Finds and eats dead animals
5. When a fuel is burned
9. The pyramid of ____ shows the combined weight of the organisms at each trophic level
10. Break down organic matter
11. Eats others for food and energy
12. A living part of an ecosystem
13. A non-living part of an ecosystem
15. Where a substance in a cycle is found
16. A living community, plus the nonliving parts
19. The percentage of energy passed from one trophic level to the next.

Possible Answers:
CARNIVORE, FLOW, HERBIVORE, PARASITE, SCAVENGER, ABIOTIC, AUTOTROPH, BIOGEOCHEMICAL, BIOMASS, BIOTIC, COMBUSTION, DECOMPOSERS, ECOSYSTEM, FECES, FIXATION, FOSSIL, HEAT, HETEROTROPH, NUMBERS, PHOTOSYNTHESIS, RESERVOIR, RESPIRATION, TEN, TROPHIC

Food Chains
Lyrics by Glenn Wolkenfeld, © 1989

Sung to the tune of *The Ballad of Jed Clampett* (also known as *The Beverly Hillbillies Song*)

Oh, a nuclear reaction happens deep inside the sun,
Where hydrogen atoms are fused into helium
Then their heat and light is radiated into space,
In 90 million miles it shines upon the Earth's face.

For every hundred calories that shine out from the sun,
The calories that green plants trap will number only one,
But every single calorie in oceans, hills, and plains,
Will serve as a foundation for a living food chain.

At the bottom of a food chain are producers like green plants
Whose cells make food from sunlight making use of chloroplasts,
It happens in the pines and flowers on your windowsill,
'Cause every single green plant's got a little chlorophyll.

Well the next step in a food chain is a primary consumer,
An herbivoric cow or vegetarian baby boomer,
A primary consumer spends its mealtimes eating plants,
It might be a buffalo or might be an ant.

Each level in a food chain yields only ten percent
Of the former level's energy you might ask where it went
There are bones and leaves you can't digest that really make a dent
And don't ignore the weighty cost of metabolic rent.

So if your plants are yielding 'bout a hundred calories,
Your yield will only be ten in the birdies and the bees.
And seven hundred calories in algae in the sea
In primary consumers it will yield you seventy.

Some other ways of getting food are really out of sight.
You could be a predator or be a parasite,
A predator eats meat a parasite eats your insides,
And if you're a decomposer you will eat me when I die!

And if you know this about food chains you can really take the cake,
When energy goes through it doesn't last, it dissipates,
But nutrients in food chains meet a very different fate,
They recycle and they circulate forever, ain't that great?

Just remember there's no beings in this world that live alone
Populations form communities where all do make their homes
Though your niche may be determining the role that you are playing.
Every creature live or dead is in a food chain.

Carbon Cycle
View it at Learn-Biology.com

I'm a carbon atom in a CO_2 up in the air,
(In the air, in the air)
Floating with the oxygen and nitrogen up there
(Nitrogen and oxygen up there)

And there I'm gonna be until I'm sucked into a tree
(Into the leaves, of a tree)
Photosynthesis captures me,
(Puts me in the leaves of a tree)

Fixed into the leaves I'm in a new situation
(Now I'm in a solid in a plant location)
'Cause photosynthesis does carbon fixation
(Carbon fixation)

CHORUS
Carbon cycle, moving me around
Gaseous in the air, solid on the ground,
Carbon cycle going 'round and 'round
(Going 'round and 'round and round)

I might be fixed into a tree, or herb or weed or shrubbery,
(Or maybe an algae, floating in the sea)
But after CO_2 in a producer's where I'll be
(Producer's where I'll be)

Formerly a gas, now I'm solid carbohydrate,
(Leaves and bark and fruit and wood are mostly carbohydrates)
Or possibly a grain of rice on someone's dinner plate,
(Someone's dinner plate)

Then maybe I'll be eaten by a deer or mouse or bird,
(Chewed up by a goat or by a buffalo herd)
After being swallowed I could be dropped as a turd,
(Dropped down as a turd)

CHORUS

In a plant or animal, I might get respired,
(For energy I'll get respired)
CO_2's released, and oxygen's required
(Oxygen's required)

Or possibly who carries me will fall dead to the ground,
(On to the soil on the ground)
Decomposers break me down as CO_2 comes out,
CO_2 comes out.

Decomposition, respiration put me in the air
(Carbon dioxide in the air)
With the clouds and nitrogen and oxygen up there
(Nitrogen and oxygen up there)

CHORUS
Or maybe I fall to the ground, no oxygen around,
Logs and leaves accumulate, pound by pound,
Makes me into fossil fuels deep under the ground,
(Deep under the ground)

They mine the coal, and oil and gas; combust me in machines
(CO_2 emitted from machines)
And now the CO_2's at levels no one's ever seen.
No one's ever seen.