KCS @ home

Summer Edition

Biology

Activity 4

knoxschools.org/kcsathome

KCS@home

Biology Activity 4 - Carbon Cycle **Name:** _____

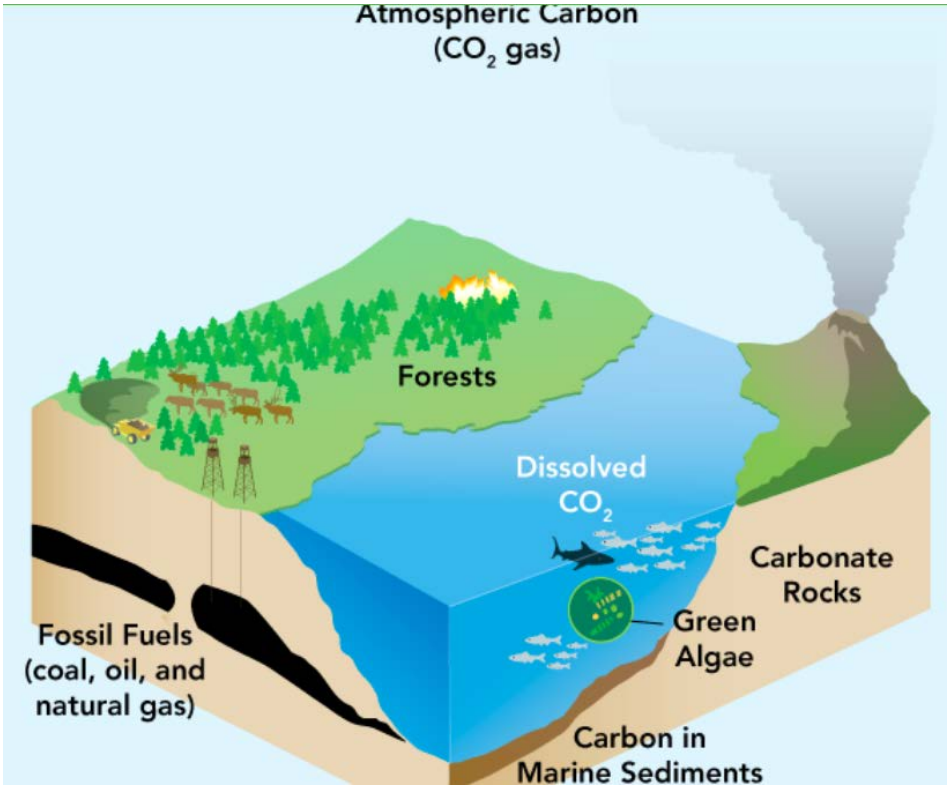
LEARNING TARGETS
- How does carbon cycle through living and nonliving parts of the ecosystem?
- How can humans affect this carbon cycle?

This worksheet is designed to complement the KCS@Home Biology Summer Content Activity 4. In the blanks provided below, complete the sentences with information from the video.

Start the video

1. First, go to the quizlet link (or here https://bit.ly/activity4prelesson) and let's see what you know about carbon. Complete the quizlet with flashcards, matching, quiz, as you review.

2. How do biological, geological, physical, chemical, and human processes intertwine? Use this diagram to illustrate with colored pencils - blue, green, red, and orange.
   Biological processes = **blue**
   Geologic processes - **green**
   Physical and chemical processes = **red**
   Human processes = **orange**



3. Let's brainstorm...where is carbon stored as pools?
   a. In _____ as a gas, carbon dioxide

b. In _____ as part of fossil fuels
c. In living things, as part of _____ - carbohydrates, _____, proteins and nucleic acids.

4. Have you heard of this before? Watch this video on a place called Pleistocene Park and answer questions when prompted - link (or here https://bit.ly/activity4pleistocenepark).

Restart the video

5. How does carbon cycle through the ecosystem?
   a. Carbon moves through pools or _____. Each time carbon moves is called a _____.

Carbon Pool Model

6. We can measure the size of the carbon pools using the unit, _____.
   a. 1 gigaton is the equivalent of _____ vehicles, or the equivalent of _____ Statues of Liberty, or the equivalent of _____ hours of water pouring over Niagara Falls.

7. Modeling the carbon pools – the rules…
   a. Each coin represents 100 gigaton (Gt) of carbon. Each coaster represents 10,000 Gt of carbon.
   b. Complete the chart to represent the coins and coasters for each carbon pool.

Model of Carbon Pools on Earth

Carbon Pool	**Carbon (Gt)**	**Number of coins (1 coin = 100 Gt, round to nearest hundred)**	**Number of coasters (1 coasters = 10,000 Gt, round to nearest ten thousand)**
Vegetation	530		
Soils	1,950		
Fossil fuel reserves	1,100		
Atmosphere	830		
Upper ocean and marine life	900		
Deep ocean	38,000		
Ocean floor surface sediment	1,750		

Restart the video

   c. Stack coins in each carbon pool. Round to the nearest hundred. (*if 620 Gt, round down to 600 and stack 6 coins)* Model for diagram is on the next page.

Carbon Pools and Exchanges

(Box areas indicate the approximate size of the corresponding carbon pool, except deep ocean, which is 1/10 scale)

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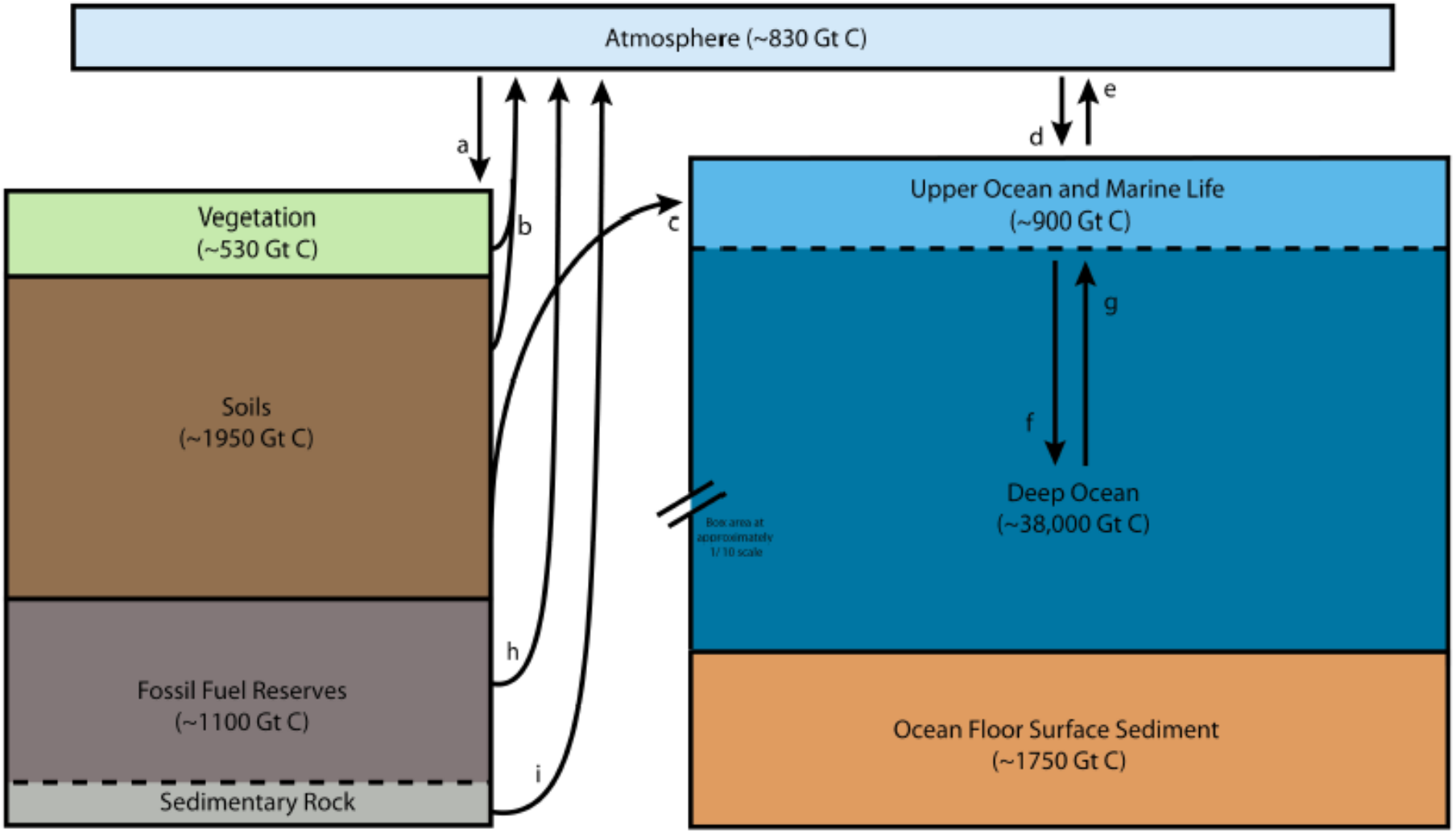

Now that you've made the model, answer these questions.

8. Name one carbon pool that surprised you the most by the amount and explain why.

9. Where is most of the carbon stored on Earth?

10. Why is most of the carbon stored in that carbon pool?

Restart the video

Movement (flux) of Carbon - Label the model with each description.

11. What do the arrows mean on the diagram? Movement of _____ from one sink to another
    a. Photosynthesis
    b. Respiration/combustion (burning biomass)
    c. Erosion/weathering
    d. Diffusion/photosynthesis
    e. Diffusion/respiration
    f. Ocean mixing and sedimentation
    g. Ocean mixing and sedimentation
    h. Combustion (fossil fuels)
    i. Volcanism

Restart the video

Human Impact on the Carbon Cycle

12. Each activity below provides a human impact on the carbon cycle. Follow along with the video and identify how carbon will move, or flux, between carbon pools.

Activity	**Description**	**Carbon Flux**
Deforestation in the Amazon	When humans cut down trees and burn them, the carbon that was stored in the trees is released.	
Planting New Trees	As newly planted trees grow, they take in more carbon dioxide to perform photosynthesis.	
Burning fossil fuels in automobiles	When humans burn fossil fuels, which take millions of years to form, the carbon in the fossil fuels is released.	
Increased cement manufacturing for dams and other building	When humans create cement for dams and other structures, they heat rock containing calcium carbonate and carbon dioxide is released.	
Capture and store carbon in geological formations	When humans capture carbon from power plants, they sometimes inject it into the ground where it is stored.	
Burning fossil fuels for electricity	When humans burn fossil fuels, which take millions of years to form, the carbon in the fossil fuels is released.	

Building homes, businesses and roadways	As building homes, businesses and roads occurs, more vegetation is lost. This leads to more weathering and erosion.	

Restart the video

13. It's time to show what you know! Complete the quizlet linked here (or here https://bit.ly/activity4postlesson) to demonstrate mastery of this subject.

Restart the video

14. Let's go back to Siberia…Should Zimov continue to build Pleistocene Park? Is this a positive or negative human impact on the carbon cycle? Keep researching and write a claim, evidence, reasoning based paragraph for your claim.
    a. Pleistocene Park website https://pleistocenepark.ru/
    b. Zimov is working with Harvard University geneticist George Church to possibly de-extinct the woolly mammoth and reintroduce into Pleistocene Park. Is this responsible? Consider the counter arguments - many say that the woolly mammoth should not be recreated or reintroduced. Consider this other perspective here https://qz.com/1566083/we-shouldnt-bring-back-extinct-animals-like-the-woolly-mammoth/

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**This lesson was modified from the online resources listed below:*
https://www.glbrc.org/outreach/educational-materials/poker-chip-model-global-carbon-pools-and-fluxes
https://www.calacademy.org/educators/lesson-plans/carbon-cycle-poster

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2. How do biological, geological, physical, chemical, and human processes intertwine? Use this diagram to illustrate with colored pencils - blue, green, red, and orange.
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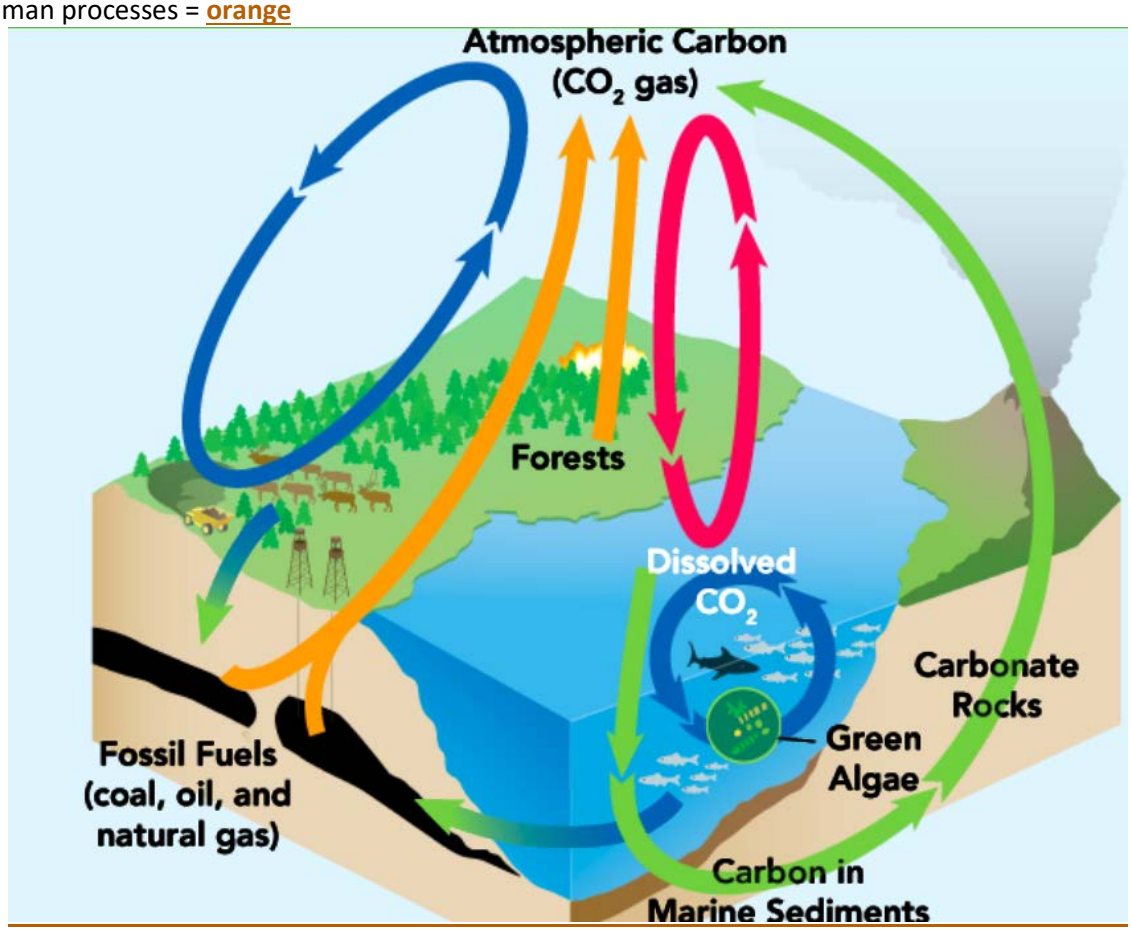


3. Let's brainstorm...where is carbon stored as pools?
   a. In atmosphere as a gas, carbon dioxide
   b. In soil as part of fossil fuels

c. In living things, as part of macromolecules - carbohydrates, lipids, proteins and nucleic acids.

4. Have you heard of this before? Watch this video on a place called Pleistocene Park and answer questions when prompted - link (or here https://bit.ly/activity4pleistocenepark).

Restart the video

5. How does carbon cycle through the ecosystem?

d. Carbon moves through pools or reservoirs. Each time carbon moves is called a flux.

Carbon Pool Model

6. We can measure the size of the carbon pools using the unit, gigaton.

e. 1 gigaton is the equivalent of 500,000,000 vehicles, or the equivalent of 4,400,000 Statues of Liberty, or the equivalent of 98 hours of water pouring over Niagara Falls.

7. Modeling the carbon pools – the rules…

f. Each coin represents 100 gigaton (Gt) of carbon. Each coaster represents 10,000 Gt of carbon.

g. Complete the chart to represent the coins and coasters for each carbon pool.

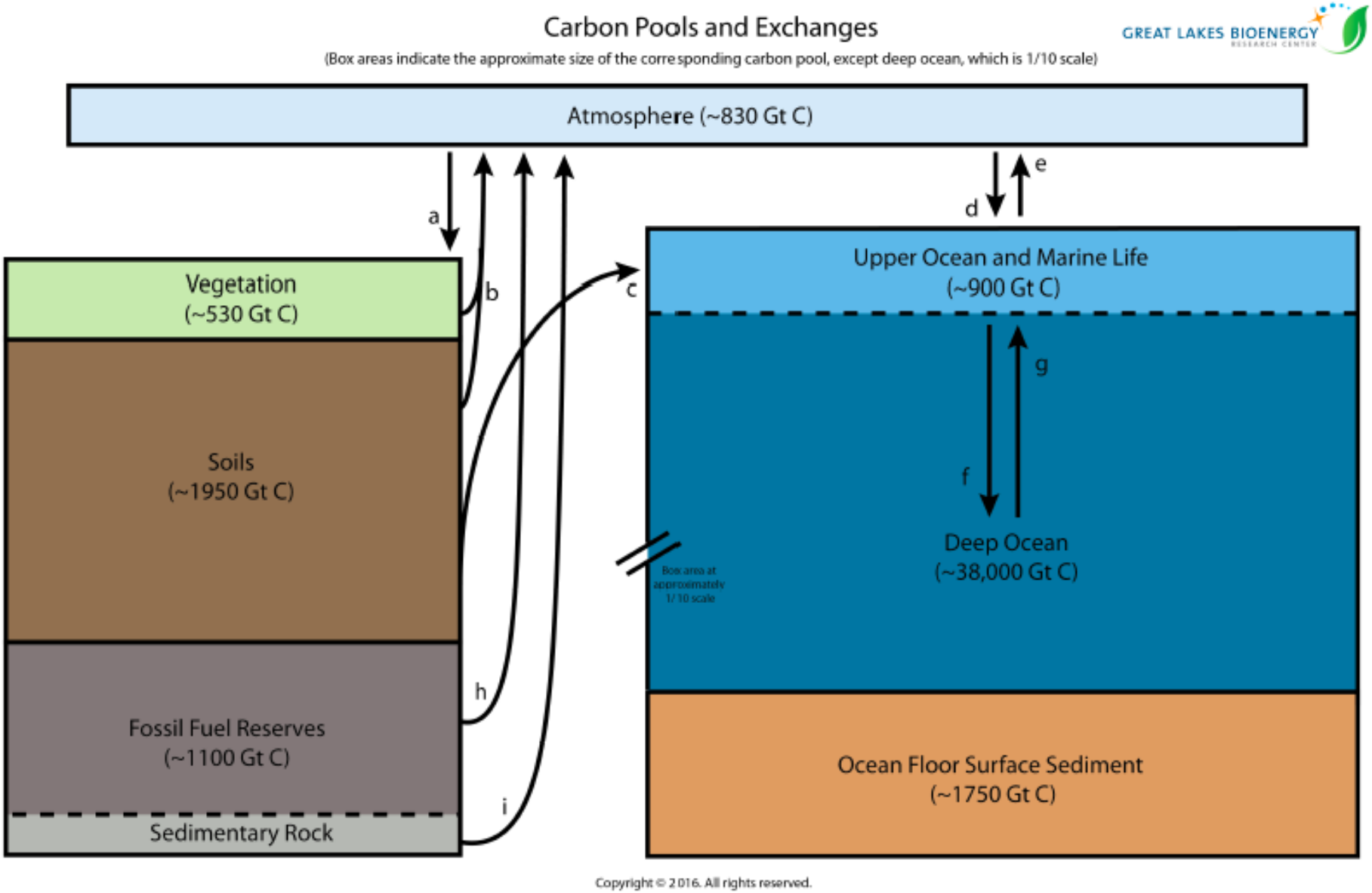
Model of Carbon Pools on Earth

Carbon Pool	Carbon (Gt)	Number of coins (1 coin = 100 Gt, round to nearest hundred)	Number of coasters (1 coasters = 10,000 Gt, round to nearest ten thousand)
Vegetation	530	5	0
Soils	1,950	20	0
Fossil fuel reserves	1,100	11	0
Atmosphere	830	8	0
Upper ocean and marine life	900	9	0
Deep ocean	38,000	0	4
Ocean floor surface sediment	1,750	18	0

Restart the video

h. Stack coins in each carbon pool. Round to the nearest hundred. (*if 620 Gt, round down to 600 and stack 6 coins)* Model for diagram is on the next page.

Now that you've made the model, answer these questions.



4. Name one carbon pool that surprised you the most by the amount and explain why.

Answers may vary.

5. Where is most of the carbon stored on Earth?

Most carbon is stored in the deep ocean, followed by the soil and fossil fuel reserves.

6. Why is most of the carbon stored in that carbon pool?

The ocean is very large (volume) compared to other pools. Despite the atmosphere holding less carbon, it is important to note that the form of carbon (CO_2 and CH_4) is very important for trapping heat and cycling between organisms and the atmosphere (photosynthesis/respiration).

Restart the video

Movement (flux) of Carbon - Label the model with each description.

7. What do the arrows mean on the diagram? Movement of carbon from one sink to another
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    c. Erosion/weathering
    d. Diffusion/photosynthesis
    e. Diffusion/respiration
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    g. Ocean mixing and sedimentation
    h. Combustion (fossil fuels)
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Activity	**Description**	**Carbon Flux**
Deforestation in the Amazon	When humans cut down trees and burn them, the carbon that was stored in the trees is released.	Vegetation to Atmosphere
Planting New Trees	As newly planted trees grow, they take in more carbon dioxide to perform photosynthesis.	Atmosphere and soil to vegetation
Burning fossil fuels in automobiles	When humans burn fossil fuels, which take millions of years to form, the carbon in the fossil fuels is released.	Fossil fuels to atmosphere
Increased cement manufacturing for dams and other building	When humans create cement for dams and other structures, they heat rock containing calcium carbonate and carbon dioxide is released.	Rock to atmosphere
Capture and store carbon in geological formations	When humans capture carbon from power plants, they sometimes inject it into the ground where it is stored.	Atmosphere to fossil fuel OR Fossil fuel to fossil fuel
Burning fossil fuels for electricity	When humans burn fossil fuels, which take millions of years to form, the carbon in the fossil fuels is released.	Fossil fuel to atmosphere
Building homes, businesses and roadways	As building homes, businesses and roads occurs, more vegetation is lost. This leads to more weathering and erosion.	Soil to upper ocean

Restart the video

9. It's time to show what you know! Complete the quizlet linked here (or here https://bit.ly/activity4postlesson) to demonstrate mastery of this subject.

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