SUSTAINABILITY

Introduction

What does sustainability mean? Sustainability Mean? What is Your Carbon /Ecological Footprint? Why is it important to learn about the impact and importance of sustainable practices on our environment, society, and economic well-being? In this assignment, you will learn about sustainability and how you can make a difference in your community. You will learn how scientists collect, organize, and analyze data.

Full assignment directions below. Please answer each question on the lab pages. Be sure to cite any sources you used using MLA or APA format. Use the student handout from HHMI: *Trends in Atmospheric Carbon Dioxide*, to complete the questions.

Sustainability

1. Explain/define sustainability. Cite source(s) using MLA or APA format.

2. Why is it important/relevant to you?

The Carbon Cycle and Sustainability

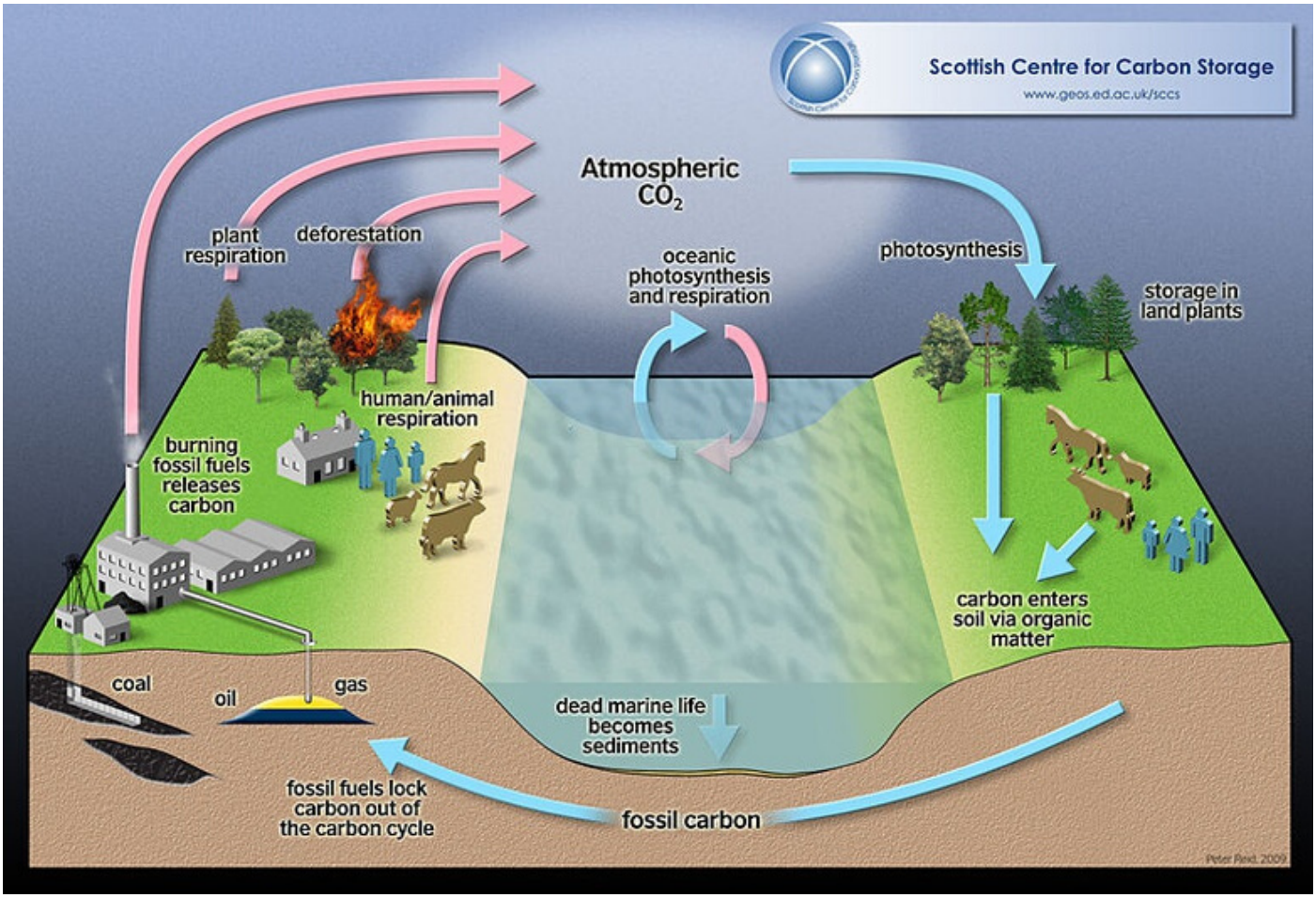
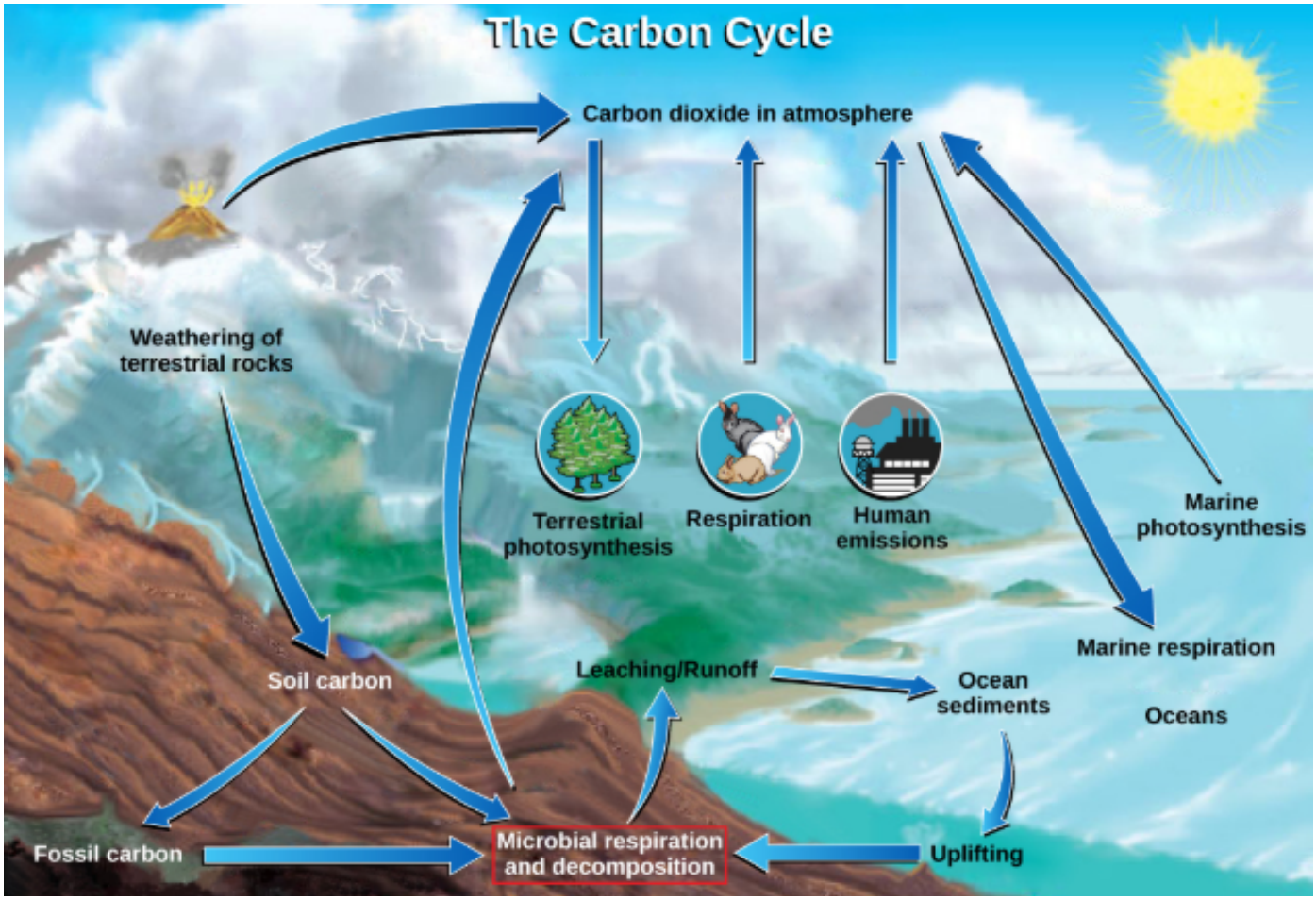


Image source: "Carbon cycle" by Scottish Carbon Capture & Storage at www.sccs.org.uk

The biosphere (or ecosphere) is the layer of our planet that contains all the living organisms (plants, animals, bacteria, fungi, protists), their interactions with one another and the Earth's abiotic (non-living) factors (wind, soil, temperature, elevation, etc.).

Biogeochemical cycles are essential to life on Earth. Important elements such as carbon, nitrogen, phosphorus move through the living and non-living parts of the Earth.

Carbon is the second most abundant element in living organisms. Carbon is present in all organic molecules, and its role in the structure of macromolecules is of primary importance to living organisms. Carbon compounds contain especially high energy, particularly those derived from fossilized organisms, mainly plants, which humans use as fuel. Since the 1800s, the number of countries using massive amounts of fossil fuels has increased. Since the beginning of the Industrial Revolution, global demand for the Earth's limited fossil fuel supplies has risen; therefore, the amount of carbon dioxide in our atmosphere has increased. This increase in carbon dioxide has been associated with climate change and other disturbances of the Earth's ecosystems and is a major environmental concern worldwide. Thus, the "carbon footprint" is based on how much carbon dioxide is produced and how much fossil fuel countries consume.



Carbon dioxide gas exists in the atmosphere and is dissolved in water. Photosynthesis converts carbon dioxide gas to organic carbon, and respiration cycles the organic carbon back into carbon dioxide gas. Long-term storage of organic carbon occurs when matter from living organisms is buried deep underground and becomes fossilized. Volcanic activity and, more recently, human emissions, bring this stored carbon back into the carbon cycle. (credit: modification of work by John M. Evans and Howard Perlman, USGS)

The Carbon Cycle and Sustainability:

1. Carbon Cycle: Search the web or your textbook to learn about the **carbon biogeochemical cycle**. Explain/discuss the carbon cycle.

2. Review the images on the previous pages. Explain how the images demonstrate the carbon cycle.

3. Discuss how humans affect the carbon cycle and its impact on sustainability.

What is your Carbon/Ecological Footprint?

Your daily activities emit carbon dioxide (CO_2). Calculators have been developed to help you determine how much CO_2 you and your family use performing daily activities.

1. Search for two different carbon/ecological footprint calculators to determine your footprint (or your family's footprint). Calculator examples include: EPA Carbon Footprint Calculator, Nature Conservancy Carbon Calculator.

2. List the two websites you used? Include the name of the website and URL.

3. Reflect on similarities and differences of each calculator. Use numerical values to explain your footprint results.

4. Make a change you feel would reduce your carbon footprint for one week (a semester). Discuss how you made the change with your family and impact it had on their living.

Data Analysis: HHMI Data Point Resource

Understanding how data is collected, organized, displayed, analyzed, and communicated is part of the scientific process. Data may show visual trends, patterns, or relationships that will help you test your hypotheses or develop future ones. This exercise will help you how to analyze visual data.

Review the student handout *Trends in Atmospheric Carbon Dioxide* from HHMI. Use the handout to answer the questions regarding the data.

Data Analysis Questions

5. Identify the type of graph? (line, bar, pie)

6. What does the X-axis (independent variable) label represent?

7. What does the Y-axis (dependent variable) label represent?

8. What does the overall trend of the graph show?

9. What was the average CO_2 concentration at the start of the study?

10. How does the average CO_2 at the start of the study compare with the CO_2 concentration in 2015? What might explain this change?

11. Concentrations of atmospheric CO_2 remained stable until the industrial revolution in the late 1800s. Industrial activity adds CO_2 to the atmosphere, but land use (whether land is used for agriculture, open space, or towns/cities) has also contributed to Earth's rising CO_2 concentration.

- How has the change in land use affected the balance of photosynthesis and respiration? How could we change land use to stabilize or reverse this trend?

CREDITS AND ATTRIBUTIONS

Meant for use with the HHMI Student Handout: *Trends in Atmospheric Carbon Dioxide.*
https://www.biointeractive.org/sites/default/files/Keeling-StudentHO-DP.pdf

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