



Climate Connections Chemistry Worksheet

This worksheet is based on National Public Radio's "Climate Connection" video series, available online at: <http://www.npr.org/news/specials/climate/video/>

- 1) Cut out the carbon, hydrogen, oxygen atom diagrams from the following pages.
- 2) Arrange the atom diagrams to create the following molecules. Ask your instructor (or look online) to determine the correct shape for each molecule:

methane (CH₄)

carbon dioxide (CO₂)

atmospheric oxygen (O₂)

water (H₂O)

glucose (C₆H₁₂O₆)

fossil carbon, such as coal (C)

- 3) **Photosynthesis.** During photosynthesis, carbon dioxide and water combine to make glucose (sugar).

a. Balance the chemical equation so that there is an equal number of each type of atom on both sides of the equation. How many atoms of CO₂ and how many atoms of H₂O are required in this reaction? How many atoms of O₂ will be produced?



b. Arrange the atom diagrams to illustrate the chemical reaction for photosynthesis, using the correct shape or structure for each molecule.

- 4) **Respiration:** When an animal eats glucose, it breaks down to form carbon dioxide and water.

a. Balance the chemical equation, so that there is an equal number of each type of atom on both sides of the reaction.



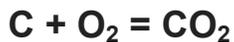
b. Arrange the atom diagrams to illustrate the chemical reaction for respiration.

- 5) **Geological carbon sequestration:** A plant full of glucose gets buried by sea level rise, and compression drives off most of the hydrogen and oxygen, leaving mostly carbon. Arrange the atom diagrams to illustrate the process of geological carbon sequestration.

One source gives the following empirical formula for bituminous coal: $C_{137}H_{97}O_9NS$. The chemical composition of coal is approximately:

75–90% Carbon
4.5–5.5% Hydrogen
1–1.5% Nitrogen
1–2% Sulfur
5–20% Oxygen
2–10% Ash
1–10% Moisture

6) **Fossil fuel burning:** Geologically sequestered carbon (such as coal) is mined and burned (combined with atmospheric oxygen) to produce energy. When coal is burned, the carbon combines with oxygen in the atmosphere to form carbon dioxide.



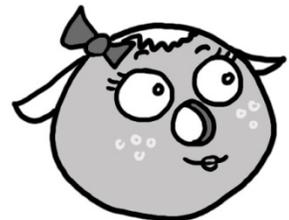
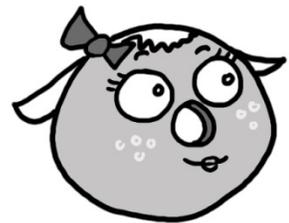
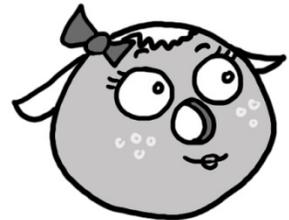
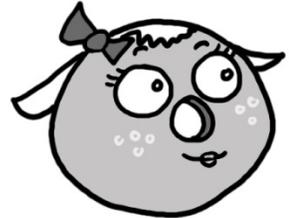
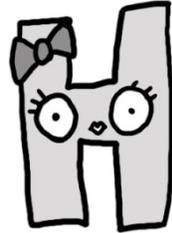
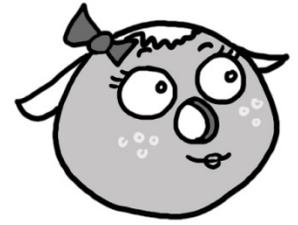
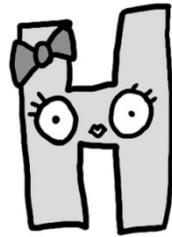
If one ton of coal is burned, approximately how many tons of carbon dioxide will be produced? _____

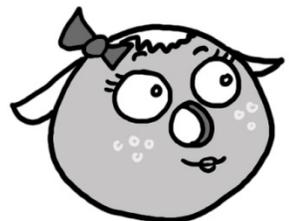
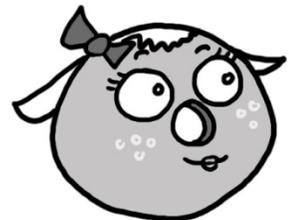
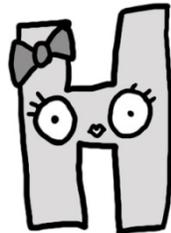
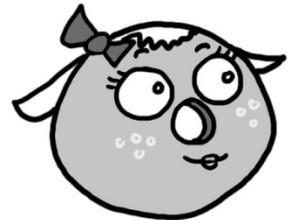
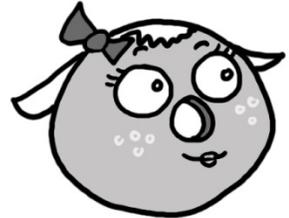
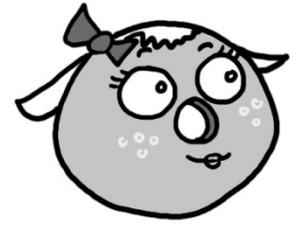
4) **OPTIONAL:** Pick one of the four chemical reactions (photosynthesis, respiration, carbon sequestration, or fossil fuel burning) and write a story about it, keeping the Carbon Cycle in mind. Add unique details to your story to make it more memorable. Make your story as compelling and memorable as possible. Write it out in detail, like instructions for a play, on a separate piece of paper. Glue or tape the cartoon chemical “actors” to the “stage” sheet. (You can print additional copies if you wish to show before and after.) You may add other elements to your story if you need to. (For instance, a calcium atom will be needed if your story will feature the $CaCO_3$ that makes up the shells of many marine creatures.)

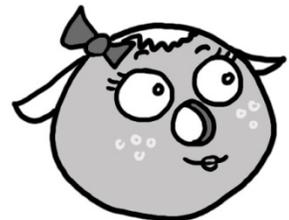
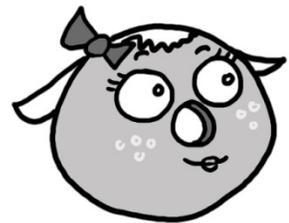
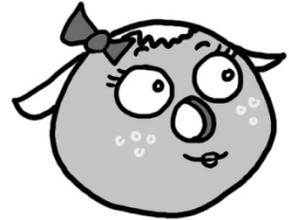
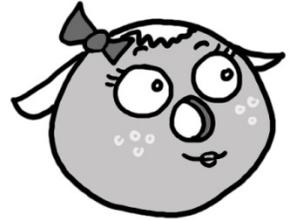
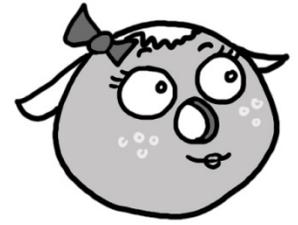
References:

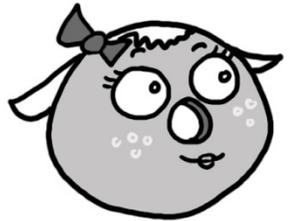
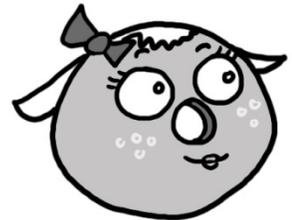
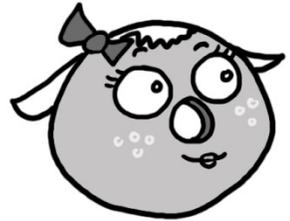
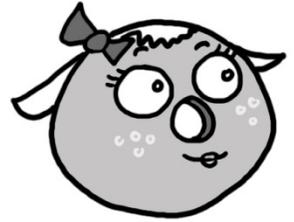
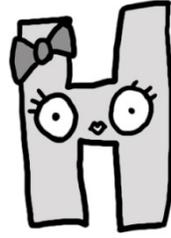
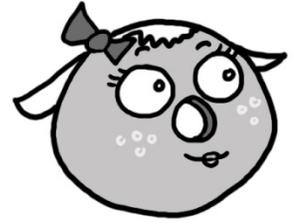
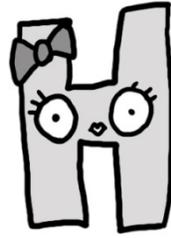
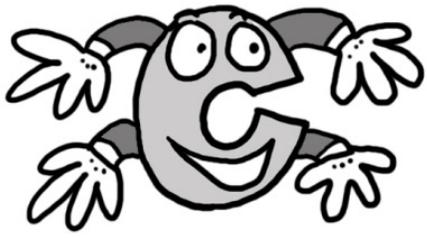
<http://www.chemistryexplained.com/Ce-Co/Coal.html>

<http://chemed.chem.purdue.edu/genchem/topicreview/bp/1organic/coal.html>









ATMOSPHERE

PLANT

ANIMAL

FOSSIL FUEL