



## **AP Environmental Science Summer Work Instructions**

Hello APES students! Glad you are here, and welcome to the start of our coverage of environmental science. Given APES is a college level course, and the goal is preparation for the AP exam in May, the bar is high for me, you and your peers. The volume of material, combined with the number of minutes we have in class together, make it impossible for us to cover all of the topics thoroughly, thus the need to cover material quickly during the year, and get a head start with this summer assignment. Much of your success in the class is built on your ability to work independently, so our summer work is to do just that, and complete the assignments listed below.

I expect your answers to show depth of thinking, carefully constructed sentences, and reasoning. Keep your eyes peeled for the due date posted OnCampus. I'll post the assignment once the new year has been loaded. The assignment will be due at some point during the first week of school in September. If you have special circumstances you are aware of now, that prevent you from completing this assignment in time, please let me know at [cbright@ves.org](mailto:cbright@ves.org).

I'll put these assignments OnCampus with a due in the first week of September as soon as next year's schedule is up and running. Thanks, have a great summer, and let me know if you have any questions.

Mr. Bright

### **Assignment #1**

Read the [forward and the first chapter of Silent Spring](#) by Rachel Carson, and watch [this YouTube clip](#) on Carson, pesticide use, and the Kennedy Administration. Then answer the questions below. Use a typed paragraph or two to answer each question. As needed, most notably for #1 and #5, consult outside sources to support your answers. You do not need to cite or footnote sources, but you should keep track of any outside sources used.

- 1) For the purpose of context, do some research on DDT (dichlorodiphenyltrichloroethane) and describe/answer the following:
  - a. Its function as a pesticide.
  - b. A brief history of its use and production in the US, as well as how the chemical was disseminated.
- 2) In the forward of Silent Spring, it is written that “. . . such a book bridges the gulf between the two cultures.”
  - a. Another excerpt from the forward: “Rachel Carson was a realistic, well-trained scientist who possessed the insight and sensitivity of a poet. She had an emotional response to nature for which she did not apologize.” Explain what is meant by this statement, using the text and the video to support your answer.
- 3) “In nature nothing exists alone.” This statement represents an idea that is a pillar in the study of ecology. How would you characterize Carson’s view of the many relationships in nature: between human beings and their environments, between plants and animals, between water and earth?
- 4) From chapter 1: “This town does not actually exist, but it might easily have a thousand counterparts in America or elsewhere in the world.”
  - a. What do you make of this statement? What point was Carson trying to make?
  - b. Is this statement grounded in science? Explain.

## **Assignment #2**

Use the link below to answer the following questions in this assignment. The answers to these questions are to be hand-written. Take pictures of your answers, paste the pictures in a Google Doc, and upload the document.

### [What is Environmental Science?](#)

- 1) At approximately 1:04, a list of topics we will cover this year is provided. Make a list of these topics, and what is meant by ‘practices?’

- 2) Describe the differences between environmental science and environmentalism.
- 3) Who is Johan Rockstrom? Draw his model of planetary boundaries.
- 4) Sustainability is defined as living within the boundaries the Earth provides. Explain this statement, and the role economy plays in this type of lifestyle.
- 5) Starting @ 5:40 and up to 6:10, the narrator highlights the other disciplines studied in the course as well as the environmental science practices. List the disciplines and practices.

### **Assignment #3**

Read the three pages below, which are excerpts from the text we will use for the course, and answer the questions below. Your answers can be typed.

- 1) Use a few sentences to describe the process of fracking. Focus on the process of fracking; How is it done? Why? What materials are mined in this process?
- 2) Use a paragraph to explain the benefits of this type of resource extraction.
- 3) What are the environmental drawbacks for fracking?

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# CHAPTER 1

## Environmental Science: Studying the State of Our Earth



## CASE STUDY

### Earthquakes, Leakage, and Wastewater: Modern-Day Consequences of Energy Production

The United States—like other developed countries—is highly dependent on **fossil fuels** such as coal, oil, and natural gas, which are derived from biological material that became fossilized millions of years ago. The use of these fossil fuels is the cause of many environmental problems including the release of pollutants into air and water and land degradation. Natural gas, also known as methane, is the least harmful producer of air pollution among the fossil fuels; it burns more completely and cleanly than coal or oil, and it contains fewer impurities.

Due to advances in technology, oil and mining companies have recently increased their reliance on *fracking*. **Fracking**, short for hydraulic fracturing, is a method of oil and gas extraction that uses high-pressure fluids to force open existing cracks in rocks deep underground. This technique allows extraction of natural gas from locations that were previously so difficult to reach that extraction was economically unfeasible. As a result, large quantities of natural gas are now available in the United States at a lower cost than before. And fracking has increased our reliance on a domestic energy source and created jobs. Roughly 40 percent of energy in the United States is used to generate electricity and from 1980 through 2000, 50 percent of that energy came from coal and only 15 percent came from natural gas. In 2017, as a result of greater natural gas availability and lower price due to fracking, 33 percent of electricity generated was from natural gas and only 30 percent from coal. Since coal emits more air pollutants—including carbon dioxide—than does natural gas, fracking and the increase in natural gas use for electricity generation initially appeared to be beneficial to the environment.

More and more studies have begun to suggest that significant quantities of natural gas escape as “leakage” during the fracking and gas extraction process.

However, reports gained attention both in the popular press and in scientific journals about the negative consequences of fracking. Large amounts of water are used in the fracking process, with millions of gallons of water taken out of local streams and rivers and pumped down or injected into each gas well. A portion of this water is later removed from the well and must be properly treated after use to avoid contaminating local water bodies.

A variety of chemicals are added to the fracking fluid to facilitate the release of natural gas. Mining companies are not required to publicly identify all of these chemicals. Environmental scientists and concerned citizens began to wonder if fracking was responsible for chemical contamination of underground water. Some drinking-water wells near fracking sites became contaminated with natural gas, and homeowners and public health officials asked if fracking was the culprit. Water with high concentrations of natural gas can be flammable, and footage of flames shooting from kitchen faucets after someone ignited the water became popular on YouTube, in documentaries, and in feature films. However, it wasn't clear if fracking caused natural gas to contaminate well water or if some of these wells contained natural gas long before fracking began. Several reputable studies showed that drinking-water wells near some fracking sites were contaminated, with natural gas concentrations in the nearby wells being much higher than in more distant wells. In addition, there has been a higher frequency of earthquakes in the central and southwest United States and the U.S. Geological Survey, the primary government agency responsible for understanding and assessing earthquakes and other geological hazards, reported in 2016 that the injection of waste water from fracking is believed to be the primary cause. These issues need further study, which may take years.

In a direct connection to global climate change, more and more studies have begun to suggest that significant quantities of natural gas escape as "leakage" during the fracking and gas extraction process. It is not known how much of the natural gas extracted each year leaks into the atmosphere, but estimates range from 2 to 10 percent. As we will learn in [Chapter 19](#) methane is 25 times more efficient at trapping heat from Earth than carbon dioxide, the *greenhouse gas most* commonly produced by human activity. Due to its high heat trapping ability, the consequences of methane leakage are potentially substantial.

Almost certainly, using natural gas is better for the environment than using coal, though using less fossil fuel—or using no fossil fuel at all—would be even better. However, at present it is difficult to know whether the benefits of using natural gas outweigh the problems that extraction causes. Many years may pass before the extent and nature of harm from fracking is known.

The story of natural gas fracking provides a good introduction to the study of environmental science. It shows us that human activities that are initially perceived as causing little harm to the environment can in fact have adverse effects, and that we may not recognize these effects until we better understand the science surrounding the issue. It also illustrates the difficulty in obtaining absolute answers to questions about the environment and demonstrates that environmental science can be controversial. Finally, it shows us that making assessments and choosing appropriate actions in environmental science are not always as clear-cut as they first appear.