Homework instructions

This homework assignment contains three parts. To complete Part 1, use the “Greenhouse Effect Survey” posted on the “Discussion Section” page of the course Blackboard site. Use Blackboard Assignment Manager to turn in Parts 2 & 3. Submit all three parts no later than one hour before the start of the section in which you are enrolled.

Part 1. Interview your fellow citizens about their understanding of the greenhouse effect.

Ask at least three people the following survey questions. Use the “Greenhouse Effect Survey” posted on the Discussion Section page of Blackboard to record your interviewees’ responses. For your reference, we have printed the survey questions here; however, be aware that only surveys that are recorded using the “Greenhouse Effect Survey” on Blackboard will receive credit.

Do not discuss the greenhouse effect, climate change, global warming, or related topics with the interviewee until after you have completed the survey.

Your interviewees must NOT be enrolled in Sustaining a Planet. Do your best to interview three people with different life experiences. For example, interviewing your 61-year-old English professor, the 31-year-old security guard in your apartment complex, and your 23-year-old cousin who studies mechanical engineering is preferable to interviewing each of your three 19-year-old roommates, all of whom study neurobiology.

Greenhouse Effect Survey questions

Note: you will fill out the survey at least three times (one time for each interviewee).

1. How old is the respondent? (sample answer: 41)

2. Describe the greenhouse effect
   a. The greenhouse effect is caused by humans. Burning fossil fuels releases very hot greenhouse gases (such as carbon dioxide) to the atmosphere. In the same way that a gardener's greenhouse keeps warm air from escaping, the top of the atmosphere traps the heated greenhouse gases near Earth's surface. The trapped, heated greenhouse gases cause the average temperature of the air near Earth's surface to increase.
   b. The greenhouse effect is caused by humans. When carbon dioxide released by the burning of fossil fuels removes ozone from the atmosphere, an ozone "hole" develops. Ozone is important because it protects life on Earth from harmful solar radiation. As the ozone hole continues to grow, more and more solar radiation can reach Earth's surface, which warms the air near Earth's surface.
   c. Without the greenhouse effect, Earth would be cold and uninhabitable. The greenhouse effect is a natural process that works because greenhouse gases (like carbon dioxide) absorb longwave radiation but don't absorb visible light. Visible light from the sun passes through the atmosphere to warm Earth's surface. Earth's surface emits longwave radiation, most of which is absorbed by atmospheric greenhouse
gases. The atmosphere re-emits some of that radiation back toward Earth, which warms the air near Earth's surface.

d. The greenhouse effect is an unsubstantiated idea. Natural cycles drive fluctuations in Earth's temperature and have nothing to do with carbon dioxide, which makes up a very small fraction of the atmosphere. Environmentalists and scientists have coined the term "greenhouse effect" as a catchy phrase that scares the public and motivates policymakers to fund special interests like the Nature Conservancy and the National Science Foundation.

3. How will Earth’s average surface temperature in 2100 likely compare to that of today?
   a. More than 2ºF cooler than today
   b. 1–2ºF cooler than today
   c. About the same as today
   d. 1–2ºF warmer than today
   e. 2–5º warmer than today
   f. More than 5ºF warmer than today

4. What is the importance of global warming for society?
   a. Global warming poses a grave threat to modern society; it endangers our lives and livelihoods. Policymakers must take definitive, drastic, immediate action if we are to have any hope of preserving civilization.
   b. Society must take global warming very seriously. There is still time for our individual actions, our government policies, and scientific and technological innovations to mitigate some of the hazard posed by rising average near-surface temperatures.
   c. Global warming is likely a real phenomenon that will probably have some effect on our society in the future. Policymakers and the public need to incorporate global-warming-prevention legislation, policy, and actions into practice when doing so will not harm other key U.S. interests (e.g., the economy, our food supply).
   d. The media frenzy and spotlight on global warming is a hoax purported by leftist scientists and engineers who want more money from the government. Time spent wringing our hands about something that scientists aren’t even 100% sure about is time wasted.

5. Where do you obtain information about the greenhouse effect and global warming? (Select all that apply.)
   a. My friends and family
   b. At a school or college
   c. Peer-reviewed scientific journals (e.g., Science, Nature)
   d. A television news channel (e.g., CNN, Fox News)
   e. A non-news television channel (e.g., the Discovery Channel, the Learning Channel)
   f. Movies (e.g., the Day after Tomorrow, Twister, An Inconvenient Truth)
   g. The radio (e.g., AM talk radio, National Public Radio)
   h. Newspapers and Newsmagazines (either online or print format)
Homework

Discussion Session #3 September 19–25 Climate Change

i. Magazines (e.g., The Economist, Discover)
j. Blogs
k. Google
l. Wikipedia
m. Other internet sites
n. Other source (which source?)

Part 2. Report the results of the experiment done in class in an abstract.

Write an abstract describing the fish-tank greenhouse-effect experiment done during discussion section. Your abstract should be no longer than 200 words.

Your abstract should contain the following information:
1. The science question addressed by the experiment.
2. The hypothesis developed by the class. (The hypothesis is the assumed answer to the science question.)
3. The methods used to test the hypothesis (Your description should include both a description of the “control experiment” and a description of the test-case experiment done during discussion section. Hint: in the experiment done in class, we considered using the same fish-tank model to first conduct a control experiment and then conduct a test-case experiment.)
4. The results of each experiment. (How did the temperature change?)
5. Any conclusions and implications that you can derive from the experiment. (Did the results support or disprove the hypothesis? How are the results and conclusions relevant to the real world and/or scientific research?)

See the examples of well-written abstracts and useful links included in this handout.

Part 3. Design an original experiment that tests a hypothesis of your choice.

The fish-tank model used in discussion section is an analog for the natural environment. It represents Earth’s surface (the black velvet at the base of the tank), Earth’s atmosphere (the air inside the fish tank), and the sun (the incandescent light).

Design a new experiment that uses the fish-tank model to test a hypothesis of your choice. State a testable hypothesis that addresses a science question with implications for Earth’s climate (you do not need to explicitly state the science question). Then describe an experiment that uses the fish-tank model to address your hypothesis. Your experiment should be composed of a control experiment and a test case.

You may brainstorm ideas with your colleagues, but your hypothesis and experimental design must be your own. Your answer must be 100 words or less.
Grading rubric

10 points total.

Part 1. Interviews
2/3 pt. Interview #1 (Respondent is not enrolled in *Sustaining a Planet*; responses are recorded results using Blackboard survey form)
2/3 pt. Interview #2 (Respondent is not enrolled in *Sustaining a Planet*; responses are recorded results using Blackboard survey form)
2/3 pt. Interview #3 (Respondent is not enrolled in *Sustaining a Planet*; responses are recorded results using Blackboard survey form)

Part 2. Write an Abstract
1 pt. Clearly states science question (0.5 pt. for attempt; 0.5 pt. for reasonable statement)
1 pt. Clearly states hypothesis (0.5 pt. for attempt; 0.5 pt. for reasonable statement)
1 pt. Clearly outlines methods (0.5 pt. for attempt; 0.5 pt. for reasonable statement)
1 pt. Clearly describes results (0.5 pt. for attempt; 0.5 pt. for reasonable statement)
1 pt. Clearly states conclusions and at least one implication (0.5 pt. for attempt; 0.5 pt. for reasonable statement)

Part 3. Design an Experiment
1 pt. Clearly states a testable hypothesis (0.5 pt. for attempt; 0.5 pt. for reasonable hypothesis)
1 pt. Clearly describes an experiment to test the hypothesis (0.2 pt. for reasonable attempt; 0.4 pt. for description of control experiment; 0.4 pt for description of test case).
Example of a well written abstract

Note that this abstract describes an experiment that was significantly more complex than the one undertaken in class. It is included to show an example of a well written summary of scientific research.

The effect of concentration Bradyrhizobium japonicum on the growth and nodule formation of Glycine max

Abstract

Concentration of Rhizobium has been shown to affect the biomass of associated legumes. This experiment, through the inoculation of Glycine max by progressive concentrations of Bradyrhizobium japonicum, investigated the impact of Rhizobium concentration on growth and nodule formation. Four inoculum levels in 10% gradations from 100% to 0.1% were applied to six pots of four seeds each per inoculum level. Six replicates of a control receiving only de-ionized water as an inoculum were also grown. During the run of the experiment, height of the seedlings was measured once a week and observations were made as to the relative color of the seedlings of various treatments. At the end of the experiment, the height of each plant was measured again, the wet mass was taken of the shoots and roots of the plants in each pot, and roots were checked for nodule formation. Due to time limitations on this experiment, with a run time of only five weeks, no significant data about height, color or mass differences could be collected, and no nodules were present. This is probably a result of the fact that the seedlings were still being supplied with nutrients by their cotyledon leaves. Consequently, there existed no environmental difference between experimental replicates, causing no differential growth based on Rhizobium concentration, or necessitating nodule formation.

Published at http://classweb.gmu.edu/biologyresources/writingguide/TitleandAbstract.pdf

Websites with tips for writing abstracts

The following links provide general guidelines for writing abstracts. Often, an abstract precedes a scientific journal paper that will be submitted for peer review. The following links assume that the scientists reading the information are writing longer, more detailed scientific papers. Note that for this assignment, you ONLY need to write an abstract; you do not need to write a scientific journal paper.

http://www.washington.edu/oue/summer_institute/writing.html
http://www.csupomona.edu/%7Eejclark/classes/bio190/abstract.html
http://edis.ifas.ufl.edu/BODY_WC011