ESS 200 (Stapleton) Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solutions to Practice Test Version 2: Experimental Design and Climate Change

\*\*The only section of this practice test that is different from the first practice test is part 1\*\*

Part 1: Designing experiments, Analyzing Data, Writing Lab Reports

*Directions for #1-6: Your responses in this section will be graded based on the guidelines you have been given in class. The required elements are not spelled out below, because this test section is testing your knowledge of what should go in each of these sections of a quality lab report.*

Suppose you are trying to answer the question, “Do students eat more if they have A lunch or if they have D lunch?” To answer this question, you measured the mass of food eaten by 6 students who had A lunch and 6 other students who had D lunch. For each student, you first recorded the mass of the student’s food before the student ate, and later you recorded the new mass after the student was finished. The mass eaten was the difference between the two masses.

1. Write a hypothesis for this question.

**I think D lunch students will eat more food than A lunch students, because they have to wait longer to eat lunch. That will make them hungrier.**

2. Identify the manipulated and responding variable. **Manipulated: Lunch Period**

**Responding: amount of food eaten**

3. Identify three important variables that should have been controlled in this experiment. **1) The food served 2) The length (time) of lunch**

**3) Students were of similar weight and height**

Imagine that you have conducted this experiment and that you have recorded the following data:

A Lunch Data (grams): 200, 240, 430, 180, 250, 320

D Lunch Data (grams): 150, 200, 180, 300, 100, 60

4. Create a useful table to display your data.

|  |  |  |
| --- | --- | --- |
|  | **Mass of food eaten (grams)** | |
| **Trials** | **A Lunch** | **D Lunch** |
| **1** | **150** | **200** |
| **2** | **200** | **240** |
| **3** | **180** | **430** |
| **4** | **300** | **180** |
| **5** | **100** | **250** |
| **6** | **60** | **320** |
| **Average** | **165** | **270** |

5. Use a T-Test to analyze these data. Describe your statistical test and share the results of the test. [The screen shot above shows where you can find a link to the statistical test on the home page at www.mrstapleton.com.]

**I used a one-tailed T-Test for two independent means. [ It was one-tailed, because I chose sides in my hypothesis. I used the independent means test because the students in each group were entirely different people. ] My p-value was**  0.015478

6. Write a conclusion for your experiment.

**My hypothesis was supported. D lunch students ate an average of 270g of food, compared to an average of 165g for A lunch students. Furthermore, this difference is significant, because the p-value of my statistical test was 0.015, which is below the significance cutoff of 0.05. D lunch students do appear to eat more.**

Part 2: Scientific Method Matching: Match each of the terms below to a description that follows. Most of the descriptions match up with exactly one term, but **two of the descriptions will each be paired with two terms**.

Manipulated Variable Responding Variable Controlled Variable Dependent Variable Independent Variable Sample Size Hypothesis Results Conclusion Procedure P-value

Precision

7. **Precision:** the consistency of a measuring instrument

8. **Controlled Variable:** something that needs to be kept the same in an experiment

9. **Conclusion:** a statement, supported by citing data, about whether your hypothesis was supported or rejected.

10. **Sample Size:** a measure of how many times measurements were repeated (how many trials were conducted) in an experiment.

11. **Hypothesis:** an “educated guess” regarding the answer to an experimental question. This guess is made before the experiment is conducted.

12. **Results:** the data or observations recorded during an investigation

13. **Manipulated Variable (a.k.a. independent variable):** When your experiment involves a comparison of two groups, this is the one thing that should be different about the two groups.

14. **P-Value:** This could be loosely defined as a number that tells you the likelihood that the results of your experiment were due to random chance, assuming that there is no actual difference between your test groups.

15. **Responding Variable (a.k.a. dependent variable):** When you are trying to find out if there is a difference between two groups, this is what you measure when you test each group.

16. **Procedure:** This is a detailed account of all of the methods and steps that an investigator followed when he/she conducted an experiment.

Part 3: Climate Change Short Answer (from the climate change notes)

17. Why is it difficult to perform a valid scientific experiment to answer the question “is human activity contributing to global warming?” **In the case of global warming, it is difficult to control every variable except the manipulated and responding variables. An ideal way to test anthropogenic global warming would be to have at least two Earths; one that is identical to ours and another that would be identical in every way except that there would be no present or historical human activity. Unfortunately, that is impossible.**

**For #18-29, see climate notes for answers.**

18. Describe how climate scientists test whether or not a new climate model is valid, without waiting for years to see if the model has accurately predicted future climate change.

19. How do climate models support the assertion that humans are contributing to global warming?

20. What is the difference between *global warming* and *climate change*?

21. List the top 4 greenhouse gases, in order of impact, and describe at least one **important** source of each.

22. Explain how greenhouse gases contribute to global warming.

23. Describe two different ways in which deforestation can contribute to global warming.

24. Describe two natural causes of climate change.

25. Describe two different mechanisms for sea level rise resulting from global warming.

26. Describe two different positive feedback loops that can contribute to global warming, and briefly illustrate how they work.

27. Regarding the carbon cycle, describe identify two natural sources and two natural sinks of atmospheric carbon.

28. Some impacts of global warming are sea level rise and physical discomfort. List three other likely impacts of global warming.

29. Rank these storage banks of carbon from greatest (most carbon stored) to least:

Atmosphere, Surface Ocean, Soil, Deep Ocean, Plant Biomass, Fossil Pool

**1) Deep Ocean, 2) Fossil Pool, 3) Soil, 4) Ocean Surface, 5) Atmosphere, 6) Plant Biomass**