INTERACTIVE RESEARCH PLANNING FORM #2

(for rigorously designed experiments)

Name _____ **Date**

1. **What question do you plan to investigate?**

   Example: "Does moisture level affect the rate of biodegradation in compost?"

2. **Why is this question important or relevant to environmental issues?**

   Example: It will help us to figure out whether it is a good idea to add water to compost piles during dry seasons.

3. **Can you find reports by other students or professional scientists on this topic? If so, what can you learn from what has already been done?**

4. **What is your hypothesis (the prediction of what you think will happen, stated in a way that can be tested by doing an experiment)? Why did you choose this prediction?**

   Example: The composting will work best with a moderate amount of added water. We're making this prediction because Chapter 2 says that compost microbes need water for growth, but with too much water the airflow may get blocked.

INTERACTIVE RESEARCH PLANNING FORM #2 *(continued)*

5. **What is your independent variable (the factor that you will change to make one treatment different from another)?**

   Example: Our independent variable will be the amount of water in the compost mixture.

6. **What is your dependent variable? (This is the factor you will measure to determine the results of the experiment—it is called "dependent" because the results depend on changes in the independent variable from one treatment to the next.)**

   Example: Our dependent variable will be the temperature of the compost. We will measure temperature every day and compare how high it rises and how long it remains hot in the three types of compost.

If you are confused about the independent and dependent variables, it may help to think back to your research question and then think about how you might want to present the results of your experiment.

On the x-axis is your independent variable. These are the numbers that you decide in advance, to create your various treatments.

On the y-axis is your dependent variable. This is the factor you will be measuring in your experiment.

INTERACTIVE RESEARCH PLANNING FORM #2 *(continued)*

7. **What *treatments* do you plan? (Each level of your independent variable is a treatment. You should plan to change only the independent variable from one treatment to the next, keeping all other conditions constant.)**

   Example: We plan to build six bioreactors and fill them with grass clippings and wood shavings. We will add no water to two bioreactors, as much water as the grass and wood shavings will soak up in two more, and half this amount in the final two.

8. **How many *replicates* will you have for each treatment? (The more replicates you can manage, the better, but you will have to figure out how many are feasible for your experiment.)**

   Example: We will have two replicates of each treatment. These will be the two bioreactors that have the same moisture content.

9. **What is your *control* (the untreated group that serves as a standard of comparison)?**

   Example: The control will be the two bioreactors with no water added. Everything else will be kept the same as in the bioreactors with added water.

10. **What factors will you keep *constant* for all treatments? (The constants in an experiment are all the factors that do not change.)**

    Example: All the bioreactors will be identical and will be filled with the same ingredients except for the amount of water. We will store them under the same conditions at room temperature out of direct sunlight.

INTERACTIVE RESEARCH PLANNING FORM #2 *(continued)*

11. What equipment and supplies will you need?

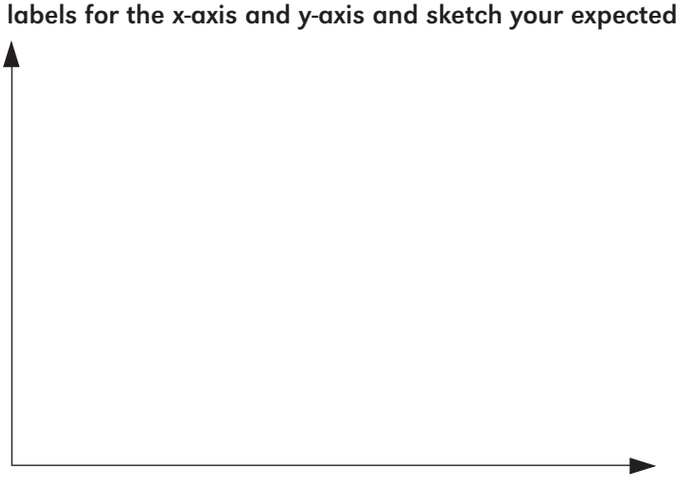
Example: We'll need all the materials listed in Protocol 12, but just one thermometer because we can use it in all the bioreactors. We'll bring in grass clippings and soda bottles from home.

12. What schedule will you follow?

Example: One class period to set up and fill the bioreactors, then for two weeks we'll just need a few minutes each day to take temperature readings. After two weeks we'll need another class period to take them apart and analyze the contents.

13. What will you measure, and how will you display your data? Sketch an empty data table here, with the appropriate headings. (Think about what kind of table you will need to record the data from your experiment.)

On this graph, add labels for the x-axis and y-axis and sketch your expected results.



INTERACTIVE RESEARCH PLANNING FORM #2 *(continued)*

A Final Check: Evaluate Your Experimental Design

1. Does your planned experiment actually test your *hypothesis*?

2. Are you changing only one *variable* at a time? Which one?

3. Will your *control* be exposed to exactly the same conditions as your treatments (except for the *independent variable*)?

4. How many *replicates* will you have for each *treatment*?

5. Meet with another student or group to discuss these plans using the **Experimental Design Peer Review Form** (p. 124). Then describe any changes you've decided to make based on this discussion.