INTERACTIVE RESEARCH PLANNING FORM 2

(for rigorously designed experiments)

Name _____ **Date**_____

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

   Example: What is the effect of earthworms on decomposition in forest soils?

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

   Example: Earthworms from Europe and Asia are invading forest soils in the northeastern U.S. Some scientists think that they may be increasing the rate of decomposition, which could cause excess nitrogen, in the form of nitrate, to be washed out of the soil. Nitrates cause contamination of lakes and groundwater.

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: Soil decomposition rates will be higher in soils with earthworms than in soils without earthworms.

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: Presence or absence of earthworms.

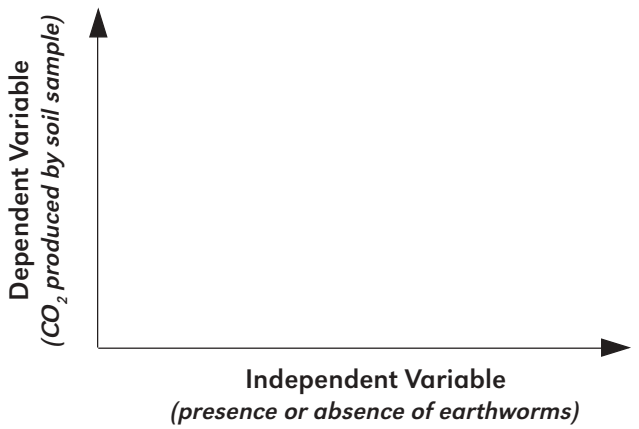
6. **What is your dependent variable? (This is the factor you will measure to determine the results of the experiment. It is called "dependent" because the results depend on changes in the independent variable from one treatment to the next.)**

   Example: CO_2 production, which is an indication of how fast organic matter in soils is decomposing.

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. For example, for a microcosm experiment with earthworms and soil, you might set up a graph that looks something like the one below before you've entered the data.

On the x-axis is your independent variable. This is the factor that you change.

On the y-axis is your dependent variable. This is the factor you will be measuring in your experiment, such as CO_2 production in soils.



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: In this experiment, I have only one treatment—presence of earthworms. I could have several treatments, such as different numbers of earthworms added to each soil sample.

8. **How many *replicates* will you have for each treatment? (These are groups of organisms that are exposed to exactly the same conditions. The more replicates you can manage, the better, but you will have to figure out how many are possible with the supplies and time you have available.)**

   Example: I can handle 5 replicates for each treatment.

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

   Example: Soils with no worms is the control. The microcosms in the control group will be exposed to all the same conditions as the microcosms in the treatment groups, except for the one variable I am testing (presence of earthworms).

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

    Examples: Temperature or light.

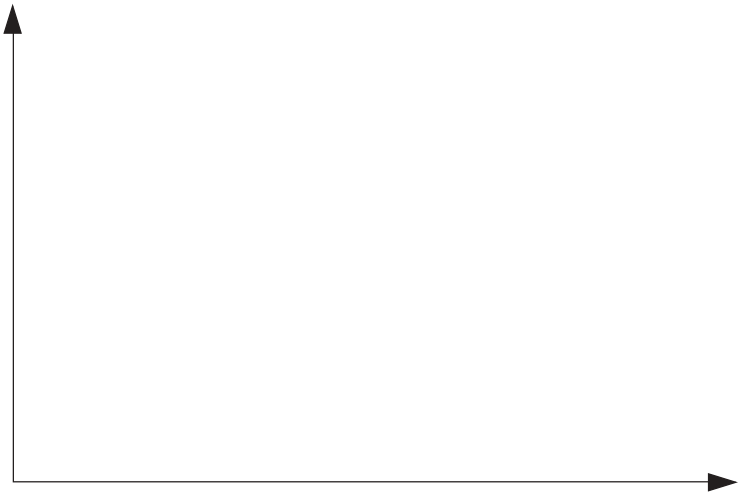
INTERACTIVE RESEARCH PLANNING FORM 2 *(continued)*

11. **What equipment and supplies will you need?**

12. **What schedule will you follow? Think about how many days will be needed for your experiment.**

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 *treatment*s (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 **Research Design Peer Review Form** (p. 174). Then describe any changes you've decided to make based on this discussion.