Lab Design Project:

An underlying concept in Ecology is the idea that Materials cycle, but Energy flows through an ecosystem. Explain why this is true. Use evidence from data presented in class that supports this statement.

The following are some essential things to consider.

- Gas exchange with atmosphere
- Getting materials into food web
- Wavelength of light needed by green plants
- Release of materials back into environment
- Release of energy back into environment

In the Lab Design Project **YOU** will design a lab to show one of the bulleted items above. You will conduct your experiment and present your finding to the class so that they can use your data to support the statement above.

First step: Prepare for Brain Storming (25 pts.)

Think about the photosynthesis/respiration cycle (otherwise known as the Carbon/Oxygen cycle). Write down what ***YOU*** think answers to the following questions might be. This will help to prepare for discussion and brain storming with your group. (Do this for EACH of the "essential things to consider" above)

- How do the bulleted items fit into that cycle?
- How could you show this to be true?
- What do you need to know to be able to show these things to be true?
- What materials do you think you would need to show this?

Controlled experiment:

Two identical experiments are conducted. In one experiment **ONE** variable is changed. In the second, identical experiment, the same variable is not changed. You do this so that you can compare the effect of changing that particular thing to see if what you changed had an effect.

Good experimental design only changes ONE THING at a time; otherwise you would not know what is causing the effect in the experiment.

Independent variable- the thing that you change in an experiment
Dependent variable- what happens because you changed something

In summary:

- The independent variable answers the question "What do I change?"
- The dependent variables answer the question "What do I observe?"
- The controlled variables answer the question "What do I keep the same?"

Variables **(from http://www.sciencebuddies.org/mentoring/project_variables.shtml)**

Scientists use an experiment to search for **cause and effect** relationships in nature. In other words, they design an experiment so that changes to one item cause something else to vary in a predictable way.

These changing quantities are called **variables**. A variable is any factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: independent, dependent, and controlled.

The **independent variable** is the one that is changed by the scientist. To insure a fair test, a good experiment has only one independent variable. As the scientist changes the independent variable, he or she **observes** what happens.

The scientist focuses his or her observations on the **dependent variable** to see how it responds to the change made to the independent variable. The new value of the dependent variable is caused by and depends on the value of the independent variable.

For example, if you open a faucet (the independent variable), the quantity of water flowing (dependent variable) changes in response--you observe that the water flow increases. The number of dependent variables in an experiment varies, but there is often more than one.

Experiments also have **controlled variables**. Controlled variables are quantities that a scientist wants to remain constant, and he must observe them as carefully as the dependent variables. For example, if we want to measure how much water flow increases when we open a faucet, it is important to make sure that the water pressure (the controlled variable) is held constant. That's because both the water pressure and the opening of a faucet have an impact on how much water flows. If we change both of them at the same time, we can't be sure how much of the change in water flow is because of the faucet opening and how much because of the water pressure. In other words, it would not be a fair test. Most experiments have more than one controlled variable. Some people refer to controlled variables as "constant variables."

In a good experiment, the scientist must be able to **measure** the values for each variable. Weight or mass is an example of a variable that is very easy to measure. However, imagine trying to do an experiment where one of the variables is love. There is no such thing as a "love-meter." You might have a **belief** that someone is in love, but you cannot really be sure, and you would probably have friends that don't agree with you. So, love is not measurable in a scientific sense; therefore, it would be a poor variable to use in an experiment.

Examples of Variables

Question	Independent Variable (What I change)	Dependent Variables (What I observe)	Controlled Variables (What I keep the same)
How much water flows through a faucet at different openings?	Water faucet opening (closed, half open, fully open)	Amount of water flowing measured in liters per minute	• The Faucet • Water pressure, or how much the water is "pushing" "Different water pressure might also cause different amounts of water to flow and different faucets may behave differently, so to insure a fair test I want to keep the water pressure and the faucet the same for each faucet opening that I test."
Does heating a cup of water allow it to dissolve more sugar?	Temperature of the water measured in degrees Centigrade	Amount of sugar that dissolves completely measured in grams	• Stirring • Type of sugar "More stirring might also increase the amount of sugar that dissolves and different sugars might dissolve in different amounts, so to insure a fair test I want to keep these variables the same for each cup of water."

Step 2: Brain Storming 25 pts

Brainstorm with your group to come up with the best idea that you can for showing that the "*essential things to consider"* are true. Come up with answers to the questions in step 1 that the whole group can agree on and that you will use when your group is assigned an "*essential thing to consider*" for your lab.

Think about the logic of each idea. Could it work? Why? Why not?

Turn ONE copy of this in with all group member names on it, your period and the date. Your grade for this portion will be based upon turning in the assigned document and how well you work within your group. (Are you participating? Are you being "bossy"? Are you accepting of ideas other than your own?)

Step 3: Design the investigation 50 pts

By the time you start step 3 you will have been assigned an "*essential thing to consider"* and you will have discussed with your group how best to try to show this; now it is time to get specific! **Use good experimental design outlined in the first part of this package!**

- Clearly state what your lab will investigate. (What part of Material Cycling or Energy Flow will it show to be true)
- Clearly state what the dependent, independent, and controlled variables are for your investigation.
- Write clear step by step instructions for how to conduct the experiment.
- Design data tables for collecting data that will be used to support your results.
- Clearly list what materials will be needed to conduct the lab investigation.

Step 4: Conduct your experiment and write it up! 50 pts

- Conduct your lab. You will be given class time to collect data from your experiment. **Each member of the team is expected to participate in data collection.**
- Write the lab up using the formal write up procedures found on the "Laboratory Write Up Requirements" sheet. **Each member of the team is expected to do their own write up.**

Step 5: Present your Results 50 pts

- Present your results to the class! You may use any presentation technique you wish (poster, power point, web page, overhead presentation, podcast)
- In your presentation you should:
  - ✓ Clearly state what your lab investigates.
  - ✓ Clearly state what you did in your lab that illustrates the point of your lab.
  - ✓ Clearly state what the dependent, independent, and controlled variables are for your investigation.
  - ✓ Clearly present evidence from your lab that supports your results.