

Name \_\_\_\_\_ Period \_\_\_\_\_

### Mesocosms (55 pts)

**AIM:** Setting up sealed mesocosms to try to establish sustainability. (Practical 5)

Mesocosms are small experimental areas that are set up as ecological experiments. Fenced-off enclosures in grassland or forests could be used as terrestrial mesocosms; tanks set up in the laboratory can be used as aquatic mesocosms. Ecological experiments can be done in replicate mesocosms, to find out the effects of varying one or more conditions. For example, tanks could be set up with and without fish, to investigate the effects of fish on aquatic ecosystems. Another possible use of mesocosms is to test what types of ecosystems are sustainable. This involves sealing up a community or organisms together with air and soil or water inside a container.

**Research Question:** *What elements are needed to create a sustainable mesocosm?*

### Set Up:

Due Date October 24th

The following site may help with the setup of your mesocosm: [magzinr.com/user/D\\_Faure/mesocosm](http://magzinr.com/user/D_Faure/mesocosm)

You should consider these questions before setting up either aquatic or terrestrial mesocosms.

- Large glass jars are ideal but transparent plastic containers could also be used.
  - Should the sides of the container be transparent or opaque?
  - Which type of container will trap more heat?
  - Which type of container will provide a better seal?
- Which of these groups of organisms must be included to make up a sustainable community: autotrophs, consumers, saprotrophs and detritivores?
  - How many organisms should be included from each group?
- How can we ensure that oxygen supply is sufficient for all the organisms in the mesocosm as once it is sealed?
  - Oxygen should not be able to enter, and carbon dioxide or water should not escape.
- How can we prevent any organisms suffering as a result of being placed in the mesocosm?
  - What kind of information will you need to research about the tolerances of each organism that you plan to use?

Here are some components you should consider while planning your mesocosm:

*Soil* – The productivity of soil depends on mineral content, drainage, water-holding capacity, air spaces, biota (animals present e.g. larvae) and the potential to hold organic matter.

*Seeds/plants* – As you have a limited growing space, your plants will need to be small. There will be a limited selection of seeds from the lab, or you can see what is available to purchase.

*Organic matter* – A mix of leaves, grass, and easily decomposed food such as fruit (do not include citrus fruit or peelings) could be used but you should think carefully about what proportion of each of these components you should use.

*Invertebrate Organisms* – Insects such as fruit flies and larvae can help decompose the detritus.

*Water* – Tap water may be treated with chemicals and so should not be used in the aquatic chamber. What would be a good source of water?

*Substrate* – You should put gravel or sand at the bottom of this chamber. Organisms you put in this chamber may need this substrate as part of their life cycle, or as a refuge.

*Organisms* – Invertebrates could be used in your mesocosm, but you should be careful to select them carefully, and limit the number of larger organisms in this chamber. Vertebrate organisms should be **avoided** if possible. Add only the number of consumers that the chamber will support.

**Data Gathering:**Observation Period October 24<sup>th</sup> - November 18<sup>th</sup>

You will need to record data 2-3 times a week. In addition you must take pictures along with your written qualitative and quantitative observations.

You must record data for a minimum of 4 weeks.

\*If the mesocosm fails within a few days, start over with another idea (it is not an excuse to stop doing the assignment)\*

Each observation should include:

- The date of your observations.
- The number of days the ecosystem has been running.
- Qualitative observations (e.g. decomposition rate, turbidity of water, and status of the species present).
- Quantitative observation (e.g. plant height and numbers of organisms)

Additional observations can include the following if you have the materials to do so:

- pH of the soil/water - You can do a before and after test since the mesocosm is sealed.
- Temperature – You can use a stick-on thermometer sold at most aquarium stores or record ambient room temperature.
- Dissolved oxygen content of the aquatic chamber – You can do a before and after test since the mesocosm is sealed. Be aware! The chemicals for this test are hazardous and expensive!
- Additional measurements (e.g. Analysis of nutrients – NPK content, etc) – You can do a before and after test since the mesocosm is sealed. Most aquarium stores sell cheap dip-strip kits that will give a good analysis of relevant nutrients.

**Website to Share your Lab Report:**Due Date December 2<sup>nd</sup>

In order to facilitate the scientific process of sharing data with other colleagues, you will create a website with the following information about your mesocosm:

**1. Introduction (5 pts):**

- A. Introduce the concept of a mesocosm.
- B. Give at least one specific example of how mesocosms are useful for actual scientific research, and how mesocosms are used to establish an ecosystem's sustainability.
- C. Discuss our research question: *What elements are needed to create a sustainable mesocosm?*
- D. Hypothesis: Will your mesocosm be sustainable? Discuss why or why not.
- E. Variables - Ideally in an experiment one variable is changed (the independent variable) and one is measured (the dependent variable). In ecosystems, there are many different variables operating at the same time. What variables will you be measuring in your mesocosm? You may want to try and change one variable and record the effect on a linked dependent variable. Which variables will you be aiming to keep the same (control variables)? It is possible that you will not be able to control other variables – these should therefore be recorded.

**2. Design (4 pts):**

- A. Describe in detail why you choose the materials and organisms for your mesocosm. Include any pertinent background research information.
- B. Give a brief outline of how your mesocosm was assembled. Photos are very helpful for this!
- C. Discuss your background research in relation to the tolerances of the organisms you included in your mesocosm.

**3. Diagrams (4 pts):**

- A. Draw a diagram (or label a picture) that shows your mesocosm and the contents in each section if there is more than one chamber.
- B. List the abiotic and biotic components. Each member of the class will have different components in their ecosystems – this will make comparisons between different mesocosms possible.

**4. Food Webs (for organisms placed in your chamber) (4 pts):**

- A. In a diagram, draw the food web you expect to see in your mesocosm.
  - i. Draw each organism as a circle and give the names (scientific or common name).
  - ii. Identify the role of each organism using appropriate letters. For example; producer – P; primary consumer (or herbivore) – C1; secondary consumer (omnivore/carnivore) – C2; tertiary consumer (carnivore) – C3; decomposer – D.
  - iii. The arrows should be directed from the energy source towards the organism that gets that energy (the arrows represent energy flow). Be sure to include the source of energy for your mesocosm, sunlight!
  - iv. Arrange the food webs so producers appear at one level (the bottom of the figure), primary consumers at the next level, and so on.

**5. Presentation and Analysis of Data (8 pts):**

- A. Present a record your data either in titled tables or a descriptive narrative. Make sure you include all qualitative data and quantitative data with relevant units.
- B. Analyse at least two of the types of quantitative data you collected through graphing. Make sure you label axes and include relevant units.
  - i. State whether the variables change over time.
  - ii. Discuss the trends are shown through the graphs.

**6. Discussion and Conclusions (12 pts):** Follow you lab notebook guidelines for the conclusion. Be sure to address the following points-

- A. What were the main limitations of your study (include at least five)?
- B. How may these limitations have affected your experiment?
- C. How could you avoid these limitations if you were to do the experiment again?

**7. References:** List at least two references you used in your research.

**Evaluation (8 pts):**

Due Date *December 9th*

You will visit at least two other class members’ mesocosm websites and write a one-paragraph analysis of the similarities and differences between your mesocosm and theirs.

**Rubric for Mesocosm Lab Report**

Task-Specific Clarification	Points
The formatting of the website is such that it is easy to navigate and understand the information presented.	4
Introduction is complete with all aspects addressed.	5
Design is well thought out, with proper background research, illustrations/photos of the setup, and thorough discussion of proper ethics (tolerances of organisms and how to avoid harming the organisms).	4
Supporting diagrams are colorful, easy to interpret and properly labeled. Abiotic and biotic factors of the mesocosm are listed.	4
Food web meets all the requirements, is neat, and has no errors in conventions.	4
At least <b>8-12</b> measured quantitative and detailed qualitative observations (2-3 per week) have been made, and are organized in an easy to follow format.	4
At least <b>two</b> types of quantitative data have been analyzed as graphs, with proper labels, units, and trends in the data well discussed with attention to how these variables affect the sustainability of the mesocosm.	8
The conclusion is insightful and addresses the key points of a conclusion and thoroughly discusses the limitations of our experiment.	12
At least <b>two</b> references are properly cited in <b>APA format</b> .	2
The evaluation references at least <b>two</b> other class member’s mesocosm websites with an in depth analysis of the mesocosms.	8
<b>TOTAL</b>	<b>55</b>

