AP Environmental Science Summer Assignments

Hi everyone and welcome to AP Environmental Science! We are going to have so much fun and learn a lot this upcoming school year. One of the key vocabulary terms that we come back to again and again in APES is “zones of ecological tolerance.” These are specific ranges of abiotic factors that a species or an individual organism can tolerate before it experiences injury or death. Abiotic factors that we refer to a lot include pH, salinity, light, and temperature. For part one of your summer assignment, you will design and conduct an experiment to test the range of tolerance of a species of plant. **You will need three consecutive weeks of being somewhere to perform this experiment.** It is okay if you get help from someone for a couple of days, but you need to be in charge of the experiment for at least 85% of the days (18/21 days).

Before getting started and choosing what you test, define the following terms (brief and simple definitions are okay). Handwrite your definitions on a piece of loose leaf and tape or glue them into your composition notebook on a page after the tasks of Part 2 are completed.

1. Abiotic:
2. Biotic:
3. pH (what does it measure and what do values on the scale mean):
4. Salinity:
5. Species:
6. Population:
7. Ecology:
8. Optimal range (ecologically speaking):
9. Zone of intolerance (ecologically speaking):

Part 1:

Design an experiment to test the zone of tolerance of a species of plant. You will keep several parts constant such as seed type, timing of experiment, etc. Choose which variable you want to change among: light, salinity, pH, or temperature. Once you decide what you want to test, see specific instructions for that variable below. Whichever variable you choose, you will follow the same general guidelines for setting up the experiment and measuring results. During the experiment, you must keep track of your data in an Excel spreadsheet or in a notebook. It is always a good idea to have a backup of the data.

General guidelines:

Materials:

- 15 pots of the same type and size, 4 inches should be plenty big. Example: https://www.homedepot.com/p/TEKU-4-in-Dia-Terra-Cotta-Pots-35-Pack-TO10D1035/303587198.
- Potting soil, all pots should have soil from the same bag. Example: https://www.homedepot.com/p/Miracle-Gro-Potting-Mix-25-qt-For-Container-Plants-Flowers-Vegetables-Shrubs-Feeds-up-to-6-Months-72781431/206457033
- Three trays for pots so water doesn't get everywhere. Example: https://www.homedepot.com/p/Viagrow-10-in-x-20-in-Extra-Strength-Quad-Seed-Starter-Propagation-Tray-V726298/307800274
- Watering apparatus - this can just be a cup, no need to buy something fancy.
- Seeds (see guidelines below)
- A camera (such as your phone)
- Gloves for planting, if desired.

Methods:

1. Choose a seed variety (see suggestions below).
2. Pack soil somewhat tightly into 15 pots but not so tight there is not oxygen able to flow through. You can choose to wear gloves or not during this part.
3. Label pots based on your three variables (see specifics below) and plant number (Example: Control, Plant 1). I like to use stickers like the ones below with the experimental group and plant number written on them, but you can also just write directly on the pot with a permanent marker or use tape that you write on. https://www.cvs.com/shop/avery-round-neon-removeable-color-coding-labels-3-4-diameter-prodid-876062?skuId=876062&cgaa=QWxsb3dHb29nbGVUb0FjY2Vzc0NWU1BhZ2Vz&gStoreCode=R10559&gQT=1

4. Make a slight indent in soil in the center of the pot with your finger, about ½ inch deep. You can choose to wear gloves or not during this part.
5. Place one seed per pot into the indent.
6. Cover seed carefully with soil and pat gently to make sure soil has contact with seed. You can choose to wear gloves or not during this part.
7. Place each experimental group in their growing areas and trays (see specifics below).
8. Water from below (in tray, not pots) until you see a seedling. You do not want to accidentally wash the seed away or bury it deeper than other seeds (seed planting depth should be kept as a constant).
9. Water as needed, based on seed packet suggestions. Soil should be damp but not soaked. (Note: if you choose to test salinity or pH, you will need to water every plant with the same amount of water and at the same frequency)
10. Check for germination daily. Once a plant has germinated, record it in your data table (see instructions below). If you are out of town on one of the days, have a friend or family member measure for you. Take pictures of each experimental group daily.
11. After the experiment, you can transplant your seedlings into a bigger pot or into your garden so you can enjoy the flowers/vegetables/fruit!

Note: if you have pets or people in your home that might disrupt the experiment, keep everything out of reach!

Specific Variable Instructions

Salinity: Water plants with varying concentrations of salt. Keep everything else constant (plant type, materials, light, pH, temperature, etc.). Make salt concentrations in one liter bottles so you have plenty to water with for three weeks. Why do you think one group is 3.5%?
If you choose this variable, you will need to water at consistent intervals and with the same amount of water for each plant.

- Three experimental groups:
    - Control (no salt)
    - 1% salt (1 gram of salt per liter)
    - 3.5% salt (3.5 grams of salt per liter)

pH: Water plants with varying pH. You will need a kit similar to the one below or you can design your own method of changing the pH. Take detailed notes whichever method you decide to use. You will definitely need pH strips for this experiment. Make solutions for each experimental group in a one liter bottle. Keep everything else constant (plant type, materials, light, salinity, temperature, etc.).
If you choose this variable, you will need to water at consistent intervals and with the same amount of water for each plant.
pH kit
pH strips

- Three experimental groups:
    - Control water (neutral pH - take note of the pH using pH strips)
    - Acidic pH water (take note of the pH using pH strips)
    - Basic pH water (take note of pH using pH strips)

Light: Expose plants to varying amounts of light. This could be difficult depending on your resources. You could get grow lights and light timers to be extremely accurate (this is kind of expensive and not necessary for this experiment), or you place each experimental group in rooms with varying amounts of light or in windows facing different directions (https://www.naplesgarden.org/its-all-about-the-lighting/). Take detailed notes on whatever method you choose. Keep everything else constant (plant type, materials, pH, salinity, temperature, etc.).

- Three experimental groups:
    - Control (standard amount of light suggested by seed packet - take note of how you decide to measure this)
    - More light (more light than suggested on seed packet - take note of how you decide to measure this)
    - Less light (less light than suggested on seed packet - take note of how you decide to measure this)

Temperature: Expose plants to varying temperatures. Changing the temperature and keeping it constant might be difficult, but you could get a heat mat if you really want to test this variable (they are kind of expensive and not necessary, it would be something like this with a thermometer https://www.homedepot.com/p/SVOPES-10-in-x-20-75-in-Seedling-Heat-Mat-with-Digital-Thermostat-MET-Listed-Heating-Pad-for-Germination-Waterproof-YMJRD10X20754L51RV1-0827/333268738). You can also design another method for changing the temperature.

- Three experimental groups:
    - Control (standard temperature as suggested on seed packet)
    - Warm temperature (you can decide what temperature to use, probably 10-15 degrees Fahrenheit higher than suggested on seed packet)
    - Cool temperature (you can decide what temperature to use, probably 10-15 degrees Fahrenheit lower than suggested on seed packet)

Seed suggestions:

These are generally **easy to grow plants with short germination times and only one variety per pack.** You are welcome to go to other stores such as local garden shops like Perino's. The links below are only examples, not ones you have to choose. You can also try other plants with short germination times (less than 7 days). Make sure to pick a seed packet with only **ONE variety** - you need to **keep this as a constant** in your experiment.

- Marigold: (Note: some varieties are toxic to cats)
    - https://www.homedepot.com/p/Ferry-Morse-Marigold-Bolero-Dwarf-Flower-Seeds-4066/329754219
    - https://www.homedepot.com/p/Ferry-Morse-Marigold-Queen-Sophia-Flower-Seeds-6023/322341872
- Zinnia:
    - https://www.homedepot.com/p/Ferry-Morse-Zinnia-Giant-Double-Flowered-Enchantress-Flower-Seeds-6756/329805562
    - https://www.homedepot.com/p/Ferry-Morse-Zinnia-Giant-Doubled-Flowered-Violet-Queen-Flower-Seeds-4072/329806910
    - https://www.homedepot.com/p/Ferry-Morse-Zinnia-Envy-Flower-Seeds-6757/329805280
- Cosmos
    - https://www.homedepot.com/p/Ferry-Morse-Cosmos-Daydream-Flower-Seed-1789/317848038
- Radish
    - https://www.homedepot.com/p/Ferry-Morse-Organic-Radish-Cherry-Belle-Vegetable-Seed-1445/326747702
    - https://www.homedepot.com/p/Ferry-Morse-Organic-Radish-Sparkler-Vegetable-Seed-0796/326751629
- Garden beans
    - https://www.homedepot.com/p/Ferry-Morse-Organic-Bean-Blue-Lake-Bush-156-Fruit-Seeds-9809/329983860#overlay
    - https://www.homedepot.com/p/Ferry-Morse-Organic-Bean-Kentucky-Wonder-Fruit-Seed-1402/326494692
- Watermelon
    - https://www.homedepot.com/p/Ferry-Morse-Organic-Watermelon-Crimson-Sweet-Fruit-Seed-1510/326884016
    - https://www.homedepot.com/p/Ferry-Morse-Watermelon-Jubilee-Fruit-Seeds-4090/329965338

Experimental Notes:

You must keep all data in one place and be well organized. When you come back for school on Wednesday, August 12, 2026 you will bring all of your data and experimental information. If you do not have the experiment complete by August 12, you will receive 10% off per day until it is done. **If it is not complete by Monday, August 17, you will not be allowed to continue in the course and must change your schedule.** This will count as a laboratory grade in the gradebook.

After you set up your experiment, write a couple of paragraphs describing how you did it. This will become part of your methods section for the lab write-up. Make a list of the materials you used. If there is any anomaly during your experiment (someone moved your plants, something got overwatered, etc.), make a note of it with the date. You should take pictures of each experimental group every day. You will record germination day and survival of plants each day in a data table similar to the one below. Record all of the variables you are keeping as constants (ex: plant variety, soil type, measuring tool, etc.)

It is okay if one or two of the plants from each group do not germinate. Depending on which variable you test, there could be an entire group of plants that do not germinate. If none of your control plants germinate after 12 days, then you might have a bad seed batch and need to try another kind of seed or seed bag.

If you have someone helping you for a couple of days, give them clear instructions on how to water and record germination and survival.

Experimental Group: 16 hours of light (control)						
Day	**Date**	**Plant 1**	**Plant 2**	**Plant 3**	**Plant 4**	**Plant 5**
1	June 4	X	X	X	X	X
2	June 5	X	X	X	X	X
3	June 6	X	X	X	X	X
4	June 7	X	Sprout	X	X	X
5	June 8	X		Sprout	Sprout	X
6	June 9	Sprout				Sprout
7	June 10					

8	June 11					
9	June 12					
10	June 13 (Dr. Jacobi took notes bc I was out of town)					
11	June 14 (Dr. Jacobi took notes bc I was out of town)					
12	June 15 (Dr. Jacobi took notes bc I was out of town)					
13	June 16					
14	June 17					Dead
15	June 18					
16	June 19					
17	June 20					
18	June 21					
19	June 22					
20	June 23					
21	June 24					

Part 2:

1. Buy a composition notebook that is required for this class as listed on the supplies list. Label the first page of the notebook “Unit 1 - The Living World: Ecosystems” and decorate the page to match the title of Unit 1.
2. Print out the Terrestrial Biome Chart. Use the Terrestrial Biomes slides to fill out the chart using the instructions provided. Once it is complete, tape or glue the chart into your composition notebook on the pages after your first page.
3. Print out the Aquatic Biomes Notes. Review the Aquatic Biomes Slides (parts 1 and 2) and take notes on the print out. You do NOT need to write every single word - take notes on what you think is most important. Once it is complete, tape or glue the chart into your composition notebook on the pages after your Terrestrial Biome Chart.
4. Study the slides and notes you took over the biomes. You will have a quiz over biomes on one of the first days of class.

Please email me with any questions: jmartin@ashrosary.org