

Science 1000 Labs and Alternatives

Introduction

This document is very important. It is THE source for information pertaining to labs and special projects in Science 1000. Please remember that the student is responsible for following the directions contained in this document. Disregard any instruction in the curriculum itself. However, when a project or lab is completed, please upload into the designated spot for grading.

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More important information – Please print!

Important: Please print off this document and reference it throughout the course. These instructions supersede anything that is written in the course labs or projects. In other words, ignore what is written in the curriculum. You will need to precisely follow these directions. You will also be copying some charts and tables from this document so be sure to save an electronic version of this onto your hard drive.

When you write your project or lab, ALWAYS use a word processing program and save a copy of your work. If I need to reassign the project, any work typed into the answer box will disappear with no means of recovery. If your report or essay has no special graphics or formatting, you can simply copy and paste it into the answer box. However, anything with pictures, bulleting, etc. should be uploaded.

The minimum number of sources for any essay is **two**. If more are required, it will be stated in the directions. Be sure to ALWAYS include your reference at the end of your assignment. Additionally, be careful not to plagiarize by copying and pasting information into your report. Short quotes are permissible, however, if referenced properly. Per school policy, a warning for plagiarism may be given once, the project reassigned and a grade no greater than an 80% be awarded. Further instances can result in a zero for the assignment and further disciplinary action.

Correct spelling and grammar is expected. You will also be graded on your organization and logical presentation of your report.

Please note that material needed for the labs that are not ordinarily found in the home are highlighted in yellow. We recommend that you look forward and plan on acquiring the materials in advance.

Unit 1

Project: Origins research

- **Write a report on the subject of origins or Creationism**

Take a subject of origins or a question you have and write a minimum of 500 words as a research project. Be sure to list all references (a minimum of 2) and resources as part of your bibliography. You may want to check out the following web sites for ideas. Consider signing up for the free and very informative news letters.

Institute for Creation Research

<http://www.icr.org/>

Answers in Genesis

<http://www.answersingenesis.org/>

Grading scale:

- | | |
|--------------------------------|------------|
| • Grading: Content | 50 pts |
| • Organization | 20 |
| • Grammar/Spelling/Punctuation | 10 |
| • Documentation | 10 |
| • Length | 10 |
| • TOTAL | 100 points |

Unit 2

Lab: pH Indicators

Here is your goal for this lesson:

- **Determine acidity and basicity of common household products utilizing indicators**

A chemical indicator is used to determine the presence of an acid or a base. Two common indicators are available at drugstores: litmus paper and phenolphthalein solution. Litmus paper is either blue or red. The red turns blue when dipped in a base, and the blue paper turns red when dipped in an acid

These materials are needed:

litmus paper (Find this in a hobby shop or anywhere where pool water testing supplies can be found. You may be able to ask – smile nicely!- for just 5 – 10 strips at the pool store since they routinely test client's water.)

Vinegar

bicarbonate of soda (Alka seltzer)

fruit juice

tomato juice

other varied household liquids

soup, etc

You will be writing your report in the following format:

There should be several sections. The **title** should be at the top.

Then, you should have a section labeled "**Purpose**". This section should include a couple sentences, at the most, about what the purpose of the lab is.

You will next have a section labeled "**Hypothesis**". You will predict what you think will happen. This should be an "educated" guess based on what you have been learning in the lessons. It is not really an opinion based on a "feeling."

Next will be a section labeled "**Methods**". You will write the steps you took in completing the experiment. You could begin this section with something like "The following steps were taken in preparing and implementing this experiment." Then, you could list the steps. **Do not** copy and paste the instructions. Your instructions must be precise enough that someone else could repeat the lab correctly.

The next section is "**Results**." You will need to logically organize all the data.

Following that will be the section "**Discussion**" where you will answer any of the questions presented in the lab. In this case, you will answer parts 2 b and c. You should integrate the questions into your answer. One word answers will NOT be accepted.

The last section will be labeled "**Conclusions**." You will summarize what you learned, the scientific principles involved, if the results were expected, and mention any possibilities for error in the experiment. Lab reports are not opinion papers. They are tools to get you to more clearly understand the material and present it in scientific terms. You will need to find and list two online sources that relate to pH. Write a short paragraph (4-6 sentences) describing what you find and be sure to give the web address as well.

Instructions

1. Test a minimum of 5 household fluids with an indicator to determine whether they are acid or base.

A. Record your results. Move on to Part 2.

Item Results

Healthy organisms have a narrow pH range but are faced with taking in or producing acids and bases. A compound called a *buffer* reacts with strong acids to make weak acids or strong bases to make weak bases so that the pH is changed only slightly.

2. Now mix tomato juice and bicarbonate of soda and test with an indicator.

B. Compare to the results of the preceding activity.

C. What is your explanation?

Grading scale: Follow required format	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Conclusions/overall impression	Max 10 points
Total points	100 points

Unit 3

Lab – Using the microscope (or alternate below)

Here is your goal for this lesson:

- Practice using a compound microscope

These supplies are needed:

compound microscope

dropper

one slide and one cover slide

water

one short piece of brightly colored thread (about 2 mm long)

Follow these directions – View the video before beginning

1. *Before* you place your slide on the stage, rotate the low power objective until it clicks into place.

2. Look through the eyepiece and turn the mirror toward a window or a lamp. **Do not get the bright sunlight in your mirror.** The sun will injure your eyes. Adjust the mirror until you see a circle of bright light through the eyepiece.

3. Use the coarse adjustment to lower the tube until the low power objective is about one-fourth inch from the stage.

4. Place a drop of water on a slide and add one or two short strands of brightly colored thread. The drop of water helps the material stick to the slide.

5. Add a cover slide.

6. Place your slide on the stage of the microscope and clip it down.

7. Looking at the slide and the objective *from the side* (*not* through the eyepiece), turn the tube down (or turn the stage up) until the eyepiece *almost* touches the slide. Now look through the eyepiece and focus by turning the tube up (or the stage down).

Never lower the tube with the coarse adjustment while looking in the eyepiece: You may crush the slide. You may also scratch the lens.

8. Look through the objective and move the slide under the objective until you locate the thread. Then use the fine adjustment to bring it into focus.

Techniques for high power.

Follow these directions.

9. Always start with low power. Repeat Steps 1 through 8 of the preceding experiment. When you have the material in focus with low power, rotate the nosepiece to the high power objective. **Do not use the coarse adjustment with the high power objective.** If you have the object in focus under low power, rotate the nosepiece to the high power objective. The material should require only a minimum of fine adjustment. If you find it necessary to turn the tube down to focus, follow Step 7 in the preceding activity.

10. Use the fine adjustment to bring into focus the materials on your slide. Take care: *never continue turning downward toward the slide.* You might crush the slide and scratch the lens. Ask your teacher or helper to observe you focus at high power and to initial below to indicate that you have learned the technique sufficiently to continue with your work.

Calculation of magnification. The limitation of light microscopy is not magnification, but *resolving power*. Resolving power measures the ability to distinguish two points clearly. Making an image larger is no advantage if the image becomes fuzzy at the same time.

The amount of magnification is calculated by multiplying the magnifying powers of the objective and the eyepiece. Your eyepiece may be 15X instead of 10X (read "fifteen power" and "ten power," respectively).

B. Calculate the power of your particular microscope at the setting you were using.

11. Write your report and include the following in this order.

- Title
- Purpose of this lab
- Methods (Describe in your own words how to properly use a microscope. Do not copy and paste the instructions! This description should be detailed enough that another person could follow the directions and use the microscope properly.
- Results (Include a description of the thread as well as the total power for each objective and your eyepiece.)
- Dig deeper (Use your search engine to find a tutorial on the proper use of a microscope. Write a 2-3 sentence description of the site and include the web address.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Microscope Alternate Lab

Steps to completion:

1. View the video on the use of a microscope in Assignment L1e.
2. Read the directions as given
3. Using an internet search engine, find 3 tutorials on using a microscope.
 - a. Read each tutorial
 - b. Write a 2-3 description of each site. Copy and paste the URLs into your report (Include in the Dig Deeper section of your report: see below)
4. Complete the following chart.

	Eyepiece	Objective lens	Total Magnification
Low power	10x	10x	
Middle power	10x	20x	
High power	10x	43x	

Write your report and include the following in this order.

- Title – (include the word alternate)
- Purpose of this lab
- Methods (Describe in your own words how to properly use a microscope. Do not copy and paste the instructions! This description should be detailed enough that another person could follow the directions and use the microscope properly.
- Results (Copy and paste the completed above chart into you report)
- Dig deeper (Use your search engine to find 3 tutorials on the proper use of a microscope. Write a 2-3 sentence description of the site and include the web address.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Lab : Human Cheek Cell (or alternative)

Here is your goal for this lesson:

- **Prepare and observe a slide of cheek cells**

In this experiment you will follow the procedures listed below. You will be observing human cheek cells. Both human and animal cells have essentially the same characteristics.

These supplies are needed:

microscope

medicine dropper

water

methylene blue stain

toothpick

slide

coverslip

Instructions – Watch the video before beginning.

1. Scrape the inside of your cheek gently with the side of a toothpick. Carefully smear this mixture of cells and saliva onto a clean glass slide.

2. Add a drop of water and a drop of the stain methylene blue. Allow the stain to stand for about one minute. Cover with a coverslip.
3. Observe under low power.
4. Proceed to observe the cells under high power, being careful not to break the slide with the objective when changing from low to high power.
5. Use your search engine to find a picture of a cheek cell and identify the major components.
6. Write your report in the following format.
 - Title
 - Purpose
 - Methods (no copying and pasting)
 - Results – Describe in detail what you saw with your microscope.
 - Discussion – From your internet search, write a paragraph about cheek cells, being sure to include the copied picture (right click... copy) and web address in this section.
 - Conclusion - Wrap up what you have learned and observed. (2 or 3 sentences)

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Cheek Cell Alternate lab (if no microscope is available)

.Directions:

1. Read the lab as written
2. Watch the video
3. Use a search engine to find three different sites that describe or show slides of cheek cells
4. Write you report in the following format
 - Title (include the word alternate)
 - Purpose
 - Results – Paste in the pictures and web addresses that you found of cheek cells

- Discussion – Write a paragraph of what you found on each of the three sites. Include the web address for each.
- Conclusion – Summarize what you have learned about cheek cells (2 -3 sentences.)

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Lab: The onion cell (or alternative)

Here is your goal for this lesson:

- **Prepare and observe a slide of onion cells**

These supplies are needed:

microscope

single-edged razor blade or exacto knife

coverslip

medicine dropper

iodine

forceps or tweezers

onion

slide (clear)

paper towel

water

Instructions.

1. Use forceps or tweezers to peel a thick layer of cells from the concave side of the leaf. Place the layer in a drop of water on a glass slide. Be careful to prevent the cells from rolling up.

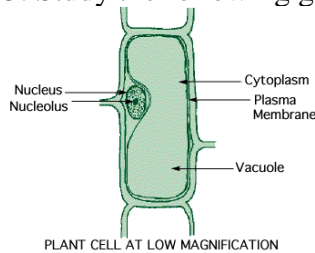
2. Place a cover slip over the cells and observe first under low power then under high power, *being careful not to crush the coverslip when changing objectives.*

Make note of the structures you observe before applying any stain.

3. Remove the slide from the microscope and apply iodine solution to the edge of the cover slip. Draw the stain onto the cells by touching a piece of paper toweling to the water at the opposite edge of the coverslip. As you learned in Science 1002, iodine reacts with *starch* to give a blue-black color. Starch is a white substance which plants use to store food.

4. Observe the cells under low and high power.

5. Study the following general diagram of the visible structures of the plant cell at this



magnification.

In what region of the cells is the stain darkest?

6. Use a search engine to find a picture of an onion cell with its parts labeled. You will copy this into your report.

7. Write your report in the following format:

- Title
- Purpose
- Methods (No copying and pasting)
- Results – Describe your results and also address the following questions in complete sentences.
 - Describe the structures you observe before applying any stain.
 - In what region of the cells is the stain darkest? Why?
- Discussion – Copy the picture you found along with the web address into this section. Write 2-3 sentences describing any information you found out about onion cells
- Conclusion – Summarize what you learned in a 2 -3sentences.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Onion Cell Alternate Lab

These are the supplies that are needed:

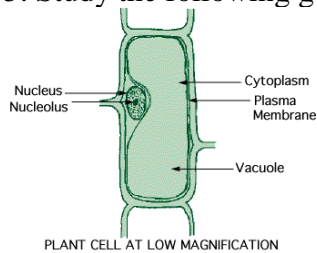
Magnifying glass
single-edged razor blade or exacto knife
medicine dropper
iodine
forceps or tweezers
onion
paper towel
water

Instructions:

1. Use forceps or tweezers to peel a thick layer of cells from the concave side of the leaf. Place the layer in a drop of water on a glass slide. Be careful to prevent the cells from rolling up.
2. Examine it with your magnifying glass.

Make note of the structures you observe before applying any stain.

3. Apply iodine solution. Draw the stain onto the cells by touching a piece of paper toweling to the water at the opposite edge. As you learned in Science 1002, iodine reacts with *starch* to give a blue-black color. Starch is a white substance which plants use to store food.
4. Observe the cells again.
5. Study the following general diagram of the visible structures of the plant cell at this



magnification. You may not be able to see the structures.

In what region of the cells is the stain darkest?

6. Use a search engine to find a picture of an onion cell with its parts labeled. You will copy this into your report.
7. Write your report in the following format:

- Title
- Purpose
- Methods (No copying and pasting)
- Results – Describe your results and also address the following questions in complete sentences.
 - Describe the structures you observe before applying any stain.
 - In what region of the cells is the stain darkest? Why?
- Discussion – Copy the picture you found along with the web address into this section. Write 2-3 sentences describing any information you found out about onion cells
- Conclusion – Summarize what you learned in a 2 -3sentences.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Lab: Osmosis

Note: Rather than the osmosis lab in the curriculum, you will pick one of the following options.

Instructions:

You will have your choice of experiments. Both use only common household items and food.

Consult the following URLs:

<http://www.spartechsoftware.com/reeko/Experiments/ExpSpinelesPotatoes.htm> (Uses potatoes)

<http://c-lab.co.uk/default.aspx?id=9&projectid=56> (Uses eggs)

Regardless of which you chose, do the following:

1. Conduct the experiment
2. Write you report using the Title/Purpose/Hypothesis/Methods/Results/Discussion/Conclusion format
3. Each section should be thorough and detailed – Be sure to include thorough discussions of isotonic, hypotonic and hypertonic means and which principles were involved in the experiment!

4. Submit it in the osmosis lab

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Unit 4

Report: Mitosis

1. In essay form, first write a general paragraph about mitosis describing why cells go through the process.
2. Describe each stage of mitosis, writing a sentence for each.
3. Use your search engine to find a picture of **3** different kinds of cells in the process of mitosis. Right click copy the picture into your report. Be sure to include the web address. (If you have a **microscope and prepared slides**, you should take a look at mitotic cells.)
4. List similarities and differences between the mitotic process for the three type of cells that you have chosen.
5. When you are sure that your project is thoroughly completed, upload and submit.

Grading scale:

• Grading: Content	50 pts
• Organization	20
• Grammar/Spelling/Punctuation	10
• Documentation	10
• Length	10
• TOTAL	100 points

Lab: Cuttings **NOTE – allow 2-3 weeks for this project.**

Here is your goal for this lesson:

- **Perform investigations of different types of cuttings**

Grow some plants from cuttings. Cuttings are the most commonly used method of growing plants. Three types of cuttings will be used in these activities.

These materials are needed:

one glass jar of 16-ounce, or larger, size
two or more flower pots of 4-inch, or larger, diameter
rich loamy soil or **potting mix**
toothpicks
a sweet potato

For stem cuttings: (One of the following common houseplants: common **coleus** (*Coleus blumei*), one of the **Philodendron** species, **purple heart** (*Setcreasea purpurea*), **wandering jew** (*Tradescantia fluminensis* var. *variegata*, *Tradescantia sillamontana*), **zebrina** (*Zebrina pendula*) or any of the commonly grown **geraniums** (*Pelargonium* sp.).

For leaf cuttings:

African violet (*Saintpaulia ionantha*), one of the **peperomias** (*Peperomia* sp.), **piggyback plant** (*Tolmiea menziesii*), **rex begonia** (*Begonia rex*), or **kalanchoe** (*Kalanchoe diagrammontianum* or *Bryophyllum diagrammontianum*).

(optional) rooting hormone such as Rootone or Hormonex in powder form.

Follow these directions and complete the activities. Complete 2 of the 3 cutting projects.

Leaf cutting instructions:

1. Make a cutting from any one of the plant species in the preceding stem cutting list. The cutting should include a minimum of three nodes in most plants and more in either philodendron or geranium. A node is the point of attachment for leaves. It also contains a bud to produce more leaves and stem tissue.
2. If a root-inducing hormone is being used, dip the cut end of the cutting into the powder and tap the end of the cutting gently on the side of the jar to shake off excess rooting hormone.
3. Place the cutting in a pot containing soil or potting medium. You should be sure that at least two nodes of the cutting are beneath the surface of the soil or potting mix.
4. Keep the pot and cutting moist. Caution: Do not keep the pot too wet, and do not allow them to dry out for long periods.

5. Wait for one to three weeks and watch for new growth from buds located above the surface. New growth will indicate that adventitious roots have formed.

The time required for the first evidence of growth in the cutting was:

Where was the first growth observed in the cutting?

Sweet potato cutting instructions

6. Insert three toothpicks into the sweet potato. They should be placed in about the middle of the sweet potato. Suspend the sweet potato in the mouth of the jar using the toothpicks. The toothpicks should rest on the rim of the jar. Be sure to have the sweet potato upright.

7. Put water into the jar so that the sweet potato has its lower portion beneath the surface.

8. In about one to two weeks you should begin to see growth from the sweet potato.

What portion of the sweet potato begins to grow first?

What kind of a cutting is a sweet potato?

What kind of structure gives rise to the stem tissue in a sweet potato?

Leaf cutting instructions

9. Place rich, loamy soil or potting mix in a flower pot.

10. Cut a leaf from one of the plants listed as being for leaf cuttings. Be sure to include the *whole* leaf.

11. Place the leaf on the planting mix in the pot. It is essential that the leaf be in good contact with the soil or potting mix. The kalanchoe, piggyback plant, and rex begonia do not require the whole leaf, but the peperomias and African violets do. In African violets and peperomias the new plant begins to grow from the base of the leaf stalk. If you have rooting hormone it may be used before placing the leaf in the pot. The leaf should be placed against the powder, and the excess tapped off.

12. Keep the pots moist. It is essential that the leaf cutting not dry out. You might consider putting the pot inside a large glass jar, putting it inside an empty aquarium, or covering the pot with some cellophane wrap.

13. In a few days you should begin to see some growth from the cutting.

What part of the new plant appeared first?

How much time passed after planting until you saw some evidence of growth?

14. Write a simple report describing your methods and results for your two chosen activities, being sure to answer the questions listed above. Each one requires one 4-6 sentence paragraph.

Grading scale:

- Grading: Content 50 pts
- Organization 20
- Grammar/Spelling/Punctuation 10
- Documentation 10
- Length 10
- TOTAL 100 points
-

Lab: Tissue structure project

Optional supplies: **Microscope and prepared slides**

1. Use a search engine to find pictures of 3 of the following:

- Striated muscle
- Kidney cells
- Liver cells
- Cardiac cells
- Red blood cells (erythrocytes)
- White blood cells (leukocytes)

(If you have a microscope and prepared slides, you should take a look at these.)

2. Do further research to investigate the structures and functions of the cells you have chosen.

3. Write a full paragraph (minimum) about each kind of cell and copy in the picture you found.

4. Be sure to include the URL for each picture as well as other references.

6. Submit after checking for completeness, spelling, and grammar.

(To clarify, this lab will be written in the fashion just described. The normal format is not necessary.)

Grading scale:

- Grading: Content 50 pts
- Organization 20
- Grammar/Spelling/Punctuation 10
- Documentation 10
- Length 10
- TOTAL 100 points

Unit 5

Lab: Probability

Here is your goal for this lesson:

- **Perform an experiment on probability**

These supplies are needed.

2 coins
 container (box or plastic container is good)

Follow these directions and complete the activities.

1. Toss a penny and record the results. Flip the penny in a cardboard box (shoebox) to prevent it from rolling away.

What are your chances for tossing a head? a tail?

2. Toss the penny 10 times and record the number of times a head appears and the number of times a tail occurs:

Single penny toss results

# tosses	# heads	# tails	% deviation
1			n/a
10			
100			

3. Calculate the **deviation** observed from the expected, using the following formula:

$$\text{Deviation} = \frac{\text{difference between expected heads and observed heads} + \text{difference between observed tails and expected tails}}{\text{Total number of tosses}}$$

For example, if I tossed a coin 10 times, I would expect to get both heads and tails 50% of the time...or 5 times. Let's say I got 8 tails and 2 heads. Then to calculate the % deviation, I do the following:

$$\frac{(5-2) + (8-5)}{10}$$

$$= \frac{(3) + (3)}{10}$$

$$= 6/10 = 0.60$$

The more the experimental results deviate from the expected results, the more the deviation value will approach the value of 1.0. As your results get closer to the expected results, the deviation is smaller and nears the value of 0.0.

4. Now continue tossing the coin and record your results until you have tossed the coin 100 times.

5. Record the total number of heads and tails you obtained.

6. Now obtain two pennies.

7. Toss the coins 100 times and record your results on the chart.

Simultaneous 2-penny toss results:

	# Heads – Heads	# Tails- Tails	# Heads - Tails
100 tosses			
% occurrence *			

*The percent of occurrence is the obtained results divided by the total tosses and multiplied by 100. For example, if I had 24 HH, 24 TT and 52 HT, the occurrence for HH would be $(24/100) \times 100 = 24\%$

8. Your report must contain the following:

- Title
- Purpose
- Hypothesis (based on what you already know about probability)
- Methods
- Results – paste the completed tables into your report document
- Discussion – Be sure to answer the following questions in complete sentences and make sure you include the question in the answer.
 - Theoretically, how does increasing the total number of coin tosses from 10 to 100 affect the deviation? Do your results support this?

- How does increasing the total number of tosses from 100 to several hundred (or added tosses) affect the deviation? Do your results support this?
- What happens to expected results when two coins are tossed? (HINT : The expected results are 50% HT, 25% HH, and 25% TT. If you tossed the two coins 500 times rather than 100 times, what do you think will happen to the actual occurrence percentages?
- Offer two important probability principles were established in this exercise.
- Conclusion – Summarizes in 2-3 sentences what you learned about probability.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Lab: Molecular genetics

NOTE – This project will take at 7-10 days. Plan ahead!

Here is your goal for this lesson:

- **Perform an experiment on molecular genetics**

These supplies will be needed:

60 radish seeds

Magnifying glass

Concave dinner plate or waxy paper plates

potting mixture or soil

box to cover the dish

Follow the directions and complete the activities. Put a check in the box when each step is completed.

1. This exercise is designed to determine to what extent the genotype and environment influence the phenotype. Obtain two plates and place the sand-peat mixture in the dishes to a depth of one centimeter.
2. Label the two dishes.
3. Pour enough water into each dish to soak the mixture and pour off the excess.
4. Obtain 60 radish seeds and spread 30 across the top of the mixture in each dish and cover with plastic wrap.

5. Put both dishes in a warm place that receives strong light (but not direct sunlight).
6. Cover one of the dishes with a box to keep the seeds in total darkness.
7. Check the dishes daily.
8. Add water if the soil begins to dry out.
9. *When half of the seeds have sprouted*, examine them. This inspection may require the use of a hand lens. The two leaves (called **cotyledons**) will be either green or yellowish. This is considered Day 1.
10. Count the number of seedlings with green leaves and those with yellow leaves.
11. Record your results.
12. Add water if needed, cover the dishes, and return them to the proper location .
13. Repeat the count the next 3 days. Record your data on the chart.
14. Calculate the percent of yellow seeds in each dish on each day. To obtain the percent, divide the total number of seedlings in the dish into the number of seedlings with yellow leaves and multiply by 100. Record your answers in the data table provided.

	Dish 1 (In light)			Dish 2 (In dark)		
Day 1	# Green	# Yellow	% Yellow	# Green	# Yellow	% Yellow
Day 2						
Day 3						
Day 4						

15. Your report must include the following:

- Title
- Purpose
- Hypothesis – Relate your hypothesis to what you know about environmental influences and genetics.
- Methods
- Results – Copy and paste the completed results chart into your report.
- Discussion – Among other things, answer the following, including the answer in your question.
 - In what way do the percentages of yellow leaves vary between dishes on Day 2?
 - How do you account for this difference?
 - Compare the percentage of yellow seedlings in Dish #2 on day 2 with the percentage on Day 4. What is the difference?
 - What experimental variable accounts for this difference?

- How can you account for the difference between the seedlings in Dish 1?
- Is the yellow color genetically or environmentally controlled?
- How can environmental factors affect inheritance?
- Conclusion – Write 2-3 sentences to sum up what you learned about the environment influences characteristics.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Unit 6

Lab: Fungi (Part 1)

Here is your goal for this lesson:

- **Observe a variety of fungi using a microscope or a hand lens**

Make a collection of fungi consisting of molds, mildew, and yeast.

These supplies are needed:

- bakers yeast
- bread
- plastic sandwich bag
- sugar
- plastic disposable tumbler
- stirring spoon
- needle
- strong magnifying glass or microscope
- two clean microscopic slides (if using microscope)
- two cover slips)if using microscope)
- Iodine or methylene blue (to be used as a stain)

Instructions.

1. Put a few drops of water on a piece of bread and place in a plastic baggy. Wait until mold forms before proceeding. (Or, if you find moldy bread on your cabinet, continue on now.)

2. Mix a packet of yeast with two cups of water and a tablespoonful of sugar. Let the mixture stand about five minutes until it gets foamy.
3. If you have a microscope, place a drop of the yeast solution on a slide. Add a drop of stain. If not, place the yeast on a plate.
4. If you have a microscope, focus the slide on low power then switch to high power. The yeasts can be seen budding. *Budding* is a type of asexual reproduction in which the cell wall of a yeast cell pushes outward. The bud constricts and pinches off by the constriction. The bud may remain attached for a while. If you have a hand magnifying glass, observe the same things.
5. Look carefully for evidence of bubbles of carbon dioxide. Yeasts consume sugar and give off carbon dioxide. The bubbles of carbon dioxide will appear as extremely tiny bubbles. Occasionally the little bubbles will combine into a large bubble. The CO₂ makes bread rise.
6. Observe mold from the bread. Make notes.
7. Write your report as follows:

Title

Purpose

Methods – As always, do not copy and paste.

Results – Describe your findings for the yeast and the bread mold.

Discussion –

- Choose 3 specific types of fungi, molds or mildews.
- Use a search engine to find both a description and a picture of what the fungi looks like
- Copy and paste a picture of the fungi into your report. (You will need to do this in a Word (or similar) document and upload it for grading.
- Write a complete, descriptive paragraph (3-4 sentences) about each type of fungi, including, life cycle, what it looks like under a microscope, whether it is harmful or not, etc.
- Include the URL for each source.

Conclusion – Summarize your findings and discuss the usefulness (as well as the dangers) of common fungi and molds. You should include at least two internet references to support your comments. This section should be at least three strong paragraphs long.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Lab: Protozoan culture (or alternate)

Here is your goal for this lesson:

- **Prepare cultures and slides with pond water**

Protozoans may be cultured in the laboratory by adding nutrient substances to pond water. The nutrients merely enhance the growth of the organisms which are already present. Prepare cultures with pond water (as discussed in first accompanying project). In a few instances water from ditches and lakes may be suitable. Try to secure some samples with a green scum of algae, because many protozoans feed on algae. Do not use chlorinated water. It will kill the cultures.

Prepare these cultures to be used later in this unit. Continue working while you are waiting for the cultures to grow.

These supplies are needed:

- four jars of pond water (label them 1, 2, 3, and 4)
- one teaspoon of chopped hay
- 1/4 teaspoon of polished rice
- 1/16 teaspoon of egg yolk
- one teaspoon of rich black garden soil
- **4 well slides** with a depression that holds a drop of water or an ordinary slide with a circle drawn around an area about the size of a dime. The circle can be drawn with Vaseline using a toothpick. This circle of Vaseline will help to keep the drop of water confined to the area.
- a tiny amount of cotton
- **microscope**
- dropper
- **4 cover slides**

Instructions. Watch the video before beginning.

1. Add one type of nutrient to each of four jars of pond water (jar 1, hay; jar 2, rice; jar 3, egg; jar 4, soil). Place the jars in subdued light. Do not place them in bright sunlight.
2. Set the cultures aside. The cultures will reach their peak of growth usually between three and five days. Check the cultures on the fifth day.
3. Proceed to the second part of this experiment.
4. Prepare a slide by adding a drop of the culture solution to a well slide or a slide in which you have prepared a well with a circle of Vaseline. Place a cover slide over the drop. Scan the area with medium power.

5. If the organisms dart about rapidly, add a few fine strands of cotton. You must pull out the cotton in such fine strands that it can scarcely be seen. The cotton will confine them.

6. Examine each of four cultures. Scan the field with medium power. Make a list of organisms which you will find in the cultures. Do not attempt to identify the species. This identification could take months. List only broad categories of protozoans. You can divide them into groups according to their movement: amoeboid, ciliated, and flagellated.

7. Using the internet's search engines, find pictures of the following: Right click copy one picture of each and paste into your Word document that will be your lab report. Be sure to also copy and paste the URL for the source of each picture.

- a. Pandorina
- b. Stentor
- c. Chlamydomonas
- d. Paramecium
- e. Amoeba
- f. Arcella
- g. Euglena
- h. Vorticella

8. Write you report as follows:

- Title
- Purpose
- Methods – Describe in detail how this lab was set up. Do not copy and paste the instructions.
- Results – Describe in detail what you saw in each of the jars. Include what you saw with the naked eye as well as with your microscope. Copy and paste the pictures of the organisms given in 7 a-h into this section (along with the web address of each)
- Discussion – Based on your results, summarize any differences between the four jars and postulate why. Use your search engine to Google “What is in pond water.” Write a 5-6 sentence paragraph describing what you find and be sure to include the web address.
- Conclusion – Compare your results with what you found in your internet search. Propose a reason for any differences.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Protozoan Alternate Lab (if you do not have a microscope)

Here is your goal for this lesson:

- **Prepare cultures with pond water**

Protozoans may be cultured in the laboratory by adding nutrient substances to pond water. The nutrients merely enhance the growth of the organisms which are already present. Prepare cultures with pond water (as discussed in first accompanying project). In a few instances water from ditches and lakes may be suitable. Try to secure some samples with a green scum of algae, because many protozoans feed on algae. Do not use chlorinated water. It will kill the cultures.

Prepare these cultures to be used later in this unit. Continue working while you are waiting for the cultures to grow.

These supplies are needed:

- four jars of pond water (label them 1, 2, 3, and 4)
- one teaspoon of chopped hay
- 1/4 teaspoon of polished rice
- 1/16 teaspoon of egg yolk
- one teaspoon of rich black garden soil
- dropper
- **Magnifying glass**

Instructions - Watch the video before beginning.

1. Add one type of nutrient to each of four jars of pond water (jar 1, hay; jar 2, rice; jar 3, egg; jar 4, soil). Place the jars in subdued light. Do not place them in bright sunlight.
2. Set the cultures aside. The cultures will reach their peak of growth usually between three and five days. Check the cultures on the fifth day.
3. Proceed to the second part of this experiment.
4. Examine each of four cultures with your naked eye and with the magnifying glass. You will want to examine each jar as a whole as well as drops of water.
5. Using the internet's search engines, find pictures of the following: Right click copy one picture of each and paste into your Word document that will be your lab report. Be sure to also copy and paste the URL for the source of each picture.
 - i. Pandorina
 - j. Stentor

- k. Chlamydomonas
- l. Paramecium
- m. Amoeba
- n. Arcella
- o. Euglena
- p. Vorticella

6. Write your report as follows:

- Title (Include the word alternate)
- Purpose
- Methods – Describe in detail how this lab was set up. Do not copy and paste the instructions.
- Results – Describe in detail what you saw in each of the jars. Include what you saw with the naked eye as well as with your magnifying glass. Copy and paste the pictures of the organisms given in 5 a-h into this section (along with the web address of each)
- Discussion – Based on your results, summarize any differences between the four jars and postulate why. Use your search engine to Google “What is in pond water.” Write a 5-6 sentence paragraph describing what you find and be sure to include the web address.
- Conclusion – Compare your results with what you found in your internet search. Propose a reason for any differences.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Unit 7

Lab: Seeds NOTE- This takes 2 weeks. PLAN AHEAD!

Here is your goal for this lesson:

- **Collect four different types of seeds and perform the investigation**

These supplies are needed:

- **four different types of seeds** (at least one grass such as corn and one bean such as a pinto bean)--at least four seeds of each kind
- magnifying glass (hand lens)
- four Styrofoam cups
- razor blade (single edge)
- **potting soil**
- water

Instructions:

1. Soak each of the seeds overnight in some water in a cup.
2. Open one of each type of seed with a razor blade
3. Use a hand lens to study the opened seeds.

Make note of what you see, paying special attention to the following.

- seed coat,
 - shoot tip
 - root tip
 - cotyledons or endosperm.
4. After poking a drainage hole into the bottom of each cup, fill each $\frac{3}{4}$ full of soil
 5. Place cups on a tray.
 6. Label each cup and plant 5 seeds into each one.
 7. Water each seed as needed to keep the soil lightly moist.
 1. Keep notes on the time for emergence, size, and growth rate for each seed.
 2. Complete the following chart (Substitute the names of your seeds across the top)
You will need to make notes when growth germination occurs, measure each plant daily, and note the appearance of the first and subsequent leaves. Feel free to adapt the chart but you must include this in your report. FYI- you can type away in any space and the size of the box will change to accommodate the text

	Seed type 1	Seed type 2	Seed type 3	Seed type 4
Day 1	1 2 3	1 2 3	1 2 3	1 2 3
Day 2	1 2	1 2	1 2	1 2

	3	3	3	3
Day 3	1 2 3	1 2 3	1 2 3	1 2 3
Day 4	1 2 3	1 2 3	1 2 3	1 2 3
Day 5	1 2 3	1 2 3	1 2 3	1 2 3
Day 6	1 2 3	1 2 3	1 2 3	1 2 3
Day 7	1 2 3	1 2 3	1 2 3	1 2 3
Day 8	1 2 3	1 2 3	1 2 3	1 2 3
Day 9	1 2 3	1 2 3	1 2 3	1 2 3
Day 10	1 2 3	1 2 3	1 2 3	1 2 3
Day 11	1 2 3	1 2 3	1 2 3	1 2 3
Day 12	1 2 3	1 2 3	1 2 3	1 2 3
Day 13	1 2 3	1 2 3	1 2 3	1 2 3
Day 14	1 2 3	1 2 3	1 2 3	1 2 3

8. Your report must include the following:

- Title
- Purpose
- Methods

- Results – Copy the chart, paste it into your document and fill in daily. Figure out the average days to germination for each type of seed. Figure out the average heights for each type at the end of the two weeks.
- Discussion – Discuss your results in detail. Be sure to include a comparison of your germination data with what was listed on the package. Discuss the differences between the monocots and the dicots.
- Conclusion – Summarize what you have learned and anything you could have done to improve your results.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Unit 8

Lab: Heart rate (L5e)

Here is your goal for this lesson:

Perform and experiment on heart rate

These supplies are needed:

Stop watch or any clock with a second hand.

Two test subjects (If at all possible, it should include the student.)

Follow these directions.

1. Find a partner to complete the experiment with you. Do not do this experiment if you or your partner has a heart condition or other medical problem.
2. Get into a restful position. Take your heart rate by placing your middle or index finger on your wrist just below the thumb. Be sure to feel a distinct pulse before you proceed further.
3. Count the number of beats in 30 seconds and multiply this number by two to get the number of beats in one minute. This will be your resting HR.
4. Exercise vigorously for three minutes. Record the HR at the appointed intervals.

5. Take your pulse rate as you exercise, and record it in the following chart.

	Person 1	Person 2
Resting heart rate (HR)		
HR directly after exercise		
HR 1 minute after exercise		
HR 2 minutes after exercise		
HR 3 minutes after exercise		

6. Have your partner complete steps two through four.

7. Write your report in the following format, making sure to include the additional information that is required. As always, complete sentences are required.

Title

Purpose

Hypothesis – Make an educated guess as to what will happen to the HR during this experiment and which of the subjects will reach a higher heart rate.

Methods

Results – In addition to completing the chart and copying it into the report, include the following information for each subject: age, sex, weight

Discussion –

1. Find a minimum of two internet sources that discuss factors that can effect HR. Write a minimum of 500 words (about 1 page, single-spaced) summarizing your findings.

2. Give the web addresses of your references.

3. Apply what you have learned to your actual experimental data. Was your data what was to be expected or not? What other factors could influence your data? What does the rate of recovery say about a person’s level of fitness? Etc.

Summary – Write 2-3 sentences summarizing what you have learned and if your hypothesis was correct or not.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Lab: Muscle types (or alternative)

Here is your goal for this lesson:

- **Observe slides of the three muscle types**

These supplies are needed:

- microscope
- raw chicken leg
- blunt probe or sturdy toothpick
- prepared slides of smooth muscle, skeletal muscle, and cardiac muscle
- latex gloves

Follow these directions and complete the activities.

1. Observe the three muscle types (skeletal, cardiac, and smooth) under high power. Note appearance. Use an internet search engine to find a picture and right click, copy for placement into the results section.

2. Obtain a raw chicken leg and remove all the skin. Be sure to wear latex gloves and take all necessary safety precautions.

3. Using a blunt probe, carefully separate the muscles in the legs to find the origin and insertion.

4. Remove one of the larger muscles with the tendons attached. Note the features.

5. Your report must include the following.

- Title
- Purpose
- Methods
- Results-
 - Write a description of the three different types of muscle fibers, comparing and contrasting similarities and differences based on what you saw.
 - Include pictures (and web sources) of each type of cell.
 - Describe the appearance of the muscle and tendons found in the chicken leg.
- Discussion –
 - Use at least 2 internet sources to describe the structure and function of each type of muscle cell. Write a paragraph for each.
 - Use the internet to find out the function and structure of tendons and ligaments. Write a paragraph for each.
 - As always, include your references.
- Conclusions: Write a 2-3 sentence summary of what you have learned.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points

Overall impression
Total points

Max 10 points
100 points

Muscle type alternate lab

Here is your goal for this lesson:

- **Observe slides of the three muscle types**

These supplies are needed:

- raw chicken leg
- blunt probe or sturdy toothpick
- latex gloves

Follow these directions and complete the activities.

1. Using an internet search engine, find a picture of each of the three types of muscle: skeletal, cardiac, and smooth. Right click, copy and place into your report in the results section.
2. Obtain a raw chicken leg and remove all the skin. Be sure to wear latex gloves and take all necessary safety precautions.
3. Using a blunt probe, carefully separate the muscles in the legs to find the origin and insertion.
4. Remove one of the larger muscles with the tendons attached. Note the features.
5. Your report must include the following.
 - Title (specify alternate)
 - Purpose
 - Methods
 - Results-
 - Write a description of the three different types of muscle fibers, comparing and contrasting similarities and differences based on what you saw.
 - Include pictures (and web sources) of each type of cell.
 - Describe the appearance of the muscle and tendons found in the chicken leg.
 - Discussion –
 - Use at least 2 internet sources to describe the structure and function of each type of muscle cell. Write a paragraph for each.

- Use the internet to find out the function and structure of tendons and ligaments. Write a paragraph for each.
- As always, include your references.
- **Conclusions:** Write a 2-3 sentence summary of what you have learned.

Grading scale: Follow format/thoroughness	Max 50 points
Spelling/grammar	Max 20 points
Validity/completeness of data	Max 20 points
Overall impression	Max 10 points
Total points	100 points

Unit 9

Essay: Habitats

Required materials:

Access to one of the following: an aquarium or zoo worker, a farmer, or a family member if you have and maintain an aquarium or terrarium.

Directions:

Interview one of the above. (For example, the keeper of the penguins at the zoo.) Develop a set of at least 10 questions that pertain to what it takes to keep a particular habitat stable. Ask if they have had any problems and how it was resolved. Use your imagination!

Write a 600 word report on what you find out. Include a list of questions asked.

Grading scale:

- Grading: Content 50 pts
- Organization 20
- Grammar/Spelling/Punctuation 10
- Documentation 10
- Length 10
- TOTAL 100 points

Project: Stewardship

You will need access to an online searchable Bible such <http://biblegateway.com>

Your task is to write a 600-word (minimum) position paper on how Christians should view their responsibility to take care of the earth. You may want to search Biblical words such as dominion, replenish, subdue, judgment, and stewardship to get some ideas. You can also search on Google to see if you can find a Biblical perspective on conservation and stewardship of resources. Be sure to list all references. (You will need at least 3 Biblical references and one other.

Take care to check for spelling, grammar, and logical presentation of ideas.

Grading scale:

• Grading: Content	50 pts
• Organization	20
• Grammar/Spelling/Punctuation	10
• Documentation	10
• Length	10
• TOTAL	100 points