IB HL Biology I Summer Assignment

Hello Future IB Biology Class,

We will begin our year investigating lab design and graph analysis. This course is rigorous, interesting, and full of scientific inquiry. Your success in HL Biology is dependent upon your study habits. The most successful students are proactive independent learners. Please expect to have 2- 5 hours of work outside of class per week.

For this summer please complete the following tasks:

1. Email me and introduce yourself: David.Krebs@knoxschools.org

2. Design an experiment and carry it out. Recommend that you begin by June 1. Below I introduce an experiment as if it is from seed – but you may choose anything

Assignment overview: This is an open inquiry experiment. So, you may investigate any topic that you are curious about. Be sure to include the following: (1)One dependent variable, (2) *One independent variable, (3)* Four experimental groups & one control group, (4) Record both quantitative and qualitative data digitally or via notebook. Do not procrastinate. It will take 1-2 weeks for the seed to germinate. Note: Not all seeds will germinate so you might want to sow more than one.

Please follow the guided note catcher on the next page to assist you along the scientific process. The last two pages of the documents are examples that you can reference. **The project is split into three phases.** Be sure to have each phase complete on the first day of school.

Email: David.Krebs@knoxschools.org

Due date: First Day of School!
Assignment should be completed in your notebook. NO LATE ASSIGNMENTS WILL BE ACCEPTED

Let's see what you can come up with!

Phase 1: Design. Draw this table in your notebook or create it digitally!

<table>
<tr><td>Investigation Brainstorm
Make a list of all your investigation ideas.</td><td>Investigation Questions
List all questions that arise as you begin the experimental process. Continue to add questions to this section throughout your investigation.</td></tr>
<tr><td colspan="2">Research and elaborate on idea
1. Choose one of your investigation ideas.
2. Complete the design table below.</td></tr>
<tr><td colspan="2">Design
1. State the investigation that you will carry out (meaning you will have to choose one from the three that you narrowed down from your research).
2. State your variables in a chart like this:
<table>
<tr><td colspan="5">Independent variable</td></tr>
<tr><td colspan="3"><u>Dependent variable for</u>
<u>Quantitative data</u></td><td colspan="2"><u>Dependent variable</u> <u>for</u> <u>Qualitative data</u>
(you can choose more than one thing to note)
Examples: You may observe that during the investigation the plant looks unhealthy, smells, moves towards the light, etc.)</td></tr>
<tr><td>Control group</td><td>Experimental group # 1</td><td>Experimental group # 2</td><td>Experimental group # 3</td><td>Experimental group # 4</td></tr>
</table>
3. List materials you will need.
4. Make a step-by-step plan for how you will carry out your investigation.
5. Draw a sketch of the experiment. Annotate your sketch by labeling what you have illustrated providing more detail to accompany the visual.</td></tr>
</table>

Phase 2: Background information. Example for Plant investigation.

What do you wonder about how plants grow and live?
Generate 3 or more **specific** questions that you have regarding how plants grow or live.
Ex: how do plants transport water, why are plants green, why and how do they bend towards light?

Write a scientific background.
The scientific background will include an introduction to your experiment and general information pertaining to plant biology. The general information will be derived from the questions generated above. Therefore, be sure to answer each of the questions that were stated above and elaborate on them in detail. This should be about one page long (or so). Demystify the science behind how plants transport water, nutrients, and bend towards light… whatever aligns best with your research question!

State a hypothesis
A hypothesis should be: **"If _____[I do this] _____, then _____[this]_____ will happen because…"**
Your hypothesis should be followed with an explanation for why you believe this.

Hypothesis:

If the amount of salt concentration is increased, then the time it takes for the hypocotyl hook of the mung bean to form will increase.

This is because salt can hinder a seed's germination (Cocoponics, 2012). Seeds may germinate slowly or become inactive unless they get oxygen, the right temperature, water and nutrients (Cocoponics, 2012). Sodium chloride prevents water from entering the seed coat by creating osmotic pressure (Cocoponics, 2012). Because of this, salt enters the seed coat instead and proves to be toxic for the plant, leading to underdevelopment or no growth at all (Cocoponics, 2012).

Phase 3: Conduct the investigation. Record your data in your notebook (this may take two months or two days- it depends on your study!)

Make two raw data tables to record all your (1) Quantitative data and (2) Qualitative data

Grading Rubric

Category	**Strong 20-15pts**	**Medium 14-9 pts**	**Low 8- 3 pts**
Design	Thoroughly complete	Complete- lacks detail	Missing 2 + items
Background info	Thoroughly complete	Complete – lacks detail	Missing 2+ items
Conduct investigation	Thoroughly complete	Complete – lacks detail	Missing some quantitative or qualitative data
Total points			**60 potential points**

Example:

Hypothesis Draft

If the amount of solid surface on top of the soil is related to the strength of the seedling, then seedlings will break through thinner surfaces more consistently and with less damage to the seedling.

Independent Variable

Varying depth of solid surfaces for seedlings to grow through

Background Questions

What species of seeds would best be used?

What type of seed has a fast germination rate and is easy to grow in controlled conditions?

What are the best solid surfaces to use? (Plaster of paris, concrete mix, spackling paste?) What other variables might be introduced by using these materials? How can I reduce these?

What are the best ways to measure "strength" of seedlings? (Crack of surfaces, speed at which they get through the surface?)

Dependent Variable

Quantitative

# of days it takes to break through surface

width/length of the crack

Thickness of seedling stem

Qualitative

Condition of the seedling during and after breaking through surfaces

Conditions of roots and seedling

Constants

Seedlings all have the same lighting, watering, and feeding schedule (plants are rotated weekly).

Data collection is done at the same time every day.

Temperature of the room remains the same for all seedlings.

Seeds of the same kind came from the same package.

Seeds are all planted in the same type and size container (clear plastic cup).

All seeds have the same quality and amount of soil underneath the solid surface.

Experimental Groups and Control Group	Control Group	Exp. Group #1	Exp. Group #2	Exp. Group #3
	No solid surface (just soil)	.5 cm depth solid surface	1 cm depth solid surface	1.5 cm depth solid surface

Constants: The factors within an experiment that are kept the same for all groups or trials in an attempt to reduce the influence of extraneous variables.

Control group: The group in an experiment that receives the exact treatment as the experimental groups *except* it does not receive any change of the independent variable. It is the group to which the experimental groups are compared.

Dependent variable (DV): The variable in an experiment that changes *in response to* the independent variable and, therefore, is also referred to as the *responding variable*.

Experimental groups: The groups or trials in an experiment that receive all the same conditions *except* varying amounts or qualities of the independent variable.

Extraneous variable: An "undesirable" variable in addition to the independent variable that may influence the results of an experiment, introducing error if it is not, as much as possible, controlled or significantly decreased in the research design.

Focal sampling: A behavioral recording technique where a *narrative* (i.e., what is called an *essay* in English class) is written on every behavior of one individual or group for a set length of time.

Hypothesis: A tentative (i.e., not final and definite) and testable proposed explanation for an observable phenomenon.

Independent variable (IV): The variable in an experiment that is purposely changed or manipulated, either in quantity or quality, by the researcher; also referred to as the *manipulated variable*.

Inference: A conclusion, based on facts, that a person perceives to be true.

Population: The complete collection of every item that has the same characteristics of the individuals in the sample group.

Qualitative data: Data that describe characteristics or qualities, such as color, odor, or texture, or data that describe category frequency or ratings, such as stem sturdiness (e.g., "sturdy," "somewhat sturdy," "limp").

Quantitative data: Data that use numbers with a unit of measurement, such as the length of an insect in millimeters (millimeter is the unit of measurement) or the weight of a projectile in kilograms (kilograms is the unit of measurement).

Sample: A subcollection of data that represent a larger population.

Scan sampling: A behavioral recording technique where the activity of the individual or group is recorded only at preselected time intervals.

Sequence sampling: A behavioral recording technique where behaviors that occur within a sequence are recorded in the order in which they occur.

Trial: The replication of experimental and control groups; used to decrease the influence of variations associated with the independent variable, researcher measurement error, and difference between entities studied.