



Honors Bio Research Project: Week 1 – Exp’t Design

Name: _____ Hour _____ Date: _____

Date Packet is due: _____ Why late? _____ Score: _____
Day of Week Date If your project was late, describe why

Directions: In this project, you will be working with your assigned group to design an experiment to test a hypothesis. Later, you will record data and observations, and form a conclusion about whether or not your hypothesis was accurate.

The design of this investigation is entirely up to you BUT you will need to get approval before you can begin. Just like real-world research, your investigation will only receive supplies and funding if your work is new, valuable, and worthwhile. Be sure to choose and plan your experiment wisely!

Week 1: Experimental Design

1. Work with your group to come up with three ideas for an independent investigation. Summarize your ideas in the spaces below.

Remember, your ideas need to be feasible for the constraints and realities for your school – you won’t be able to test anything overly complex or extensive. However, your ideas should also address questions that don’t have an easily predictable outcome and would provide valuable insights for a particular group of people.

Good example: How does Gatorade affect the growth of radishes?

Bad example: How do specific drugs affect the brains of mice. (This is not feasible in a classroom setting).

Good example: Does the hot water setting on a laundry machine result in cleaner clothes?

Bad example: Do baking soda and vinegar work to make a scale model volcano? (This is too predictable).

- a. _____

- b. _____

- c. _____

2. As a group, decide which of your three ideas is most feasible and valuable. Circle that idea above.

Research Project Schedule

Week 1: Experimental Design – Develop a research proposal to acquire finding and/or supplies to complete your work.

Week 2: Data Collection – Complete your investigation as proposed and collect data for later analysis.

Week 3: Data Analysis – Identify patterns and trends in your data, and explain these outcomes using core ideas from biology.

Week 4: Presenting Findings – Develop and deliver a formal presentation (Intro, Methods, Results, Discussion, Works Cited).

3. To begin, let's turn your idea into a **Research Question**. A research question is usually what frames and guides the entire experiment. Fill in the blanks below:

We wonder if _____

4. Now let's turn this into a **Hypothesis**. A hypothesis is the main emphasis of any experiment. It is simply an educated guess. Fill in the blanks below:

We hypothesize that if we _____

5. Now provide a **Rationale** for your hypothesis. A rationale simply states why you think your hypothesis might be right; it provides some evidence or logic that supports the validity of your hypothesis.

We think this will occur because: _____

6. Every experiment has two very important components – a *dependent variable* and an *independent variable*.

An **independent variable** is the thing you purposely changed. In this case, whatever purposely change would be your independent variable. Usually experiments only have one independent variable. *For example, if you treated radish seeds with Gatorade to make them grow faster, this would be the thing you purposely changed; the addition of Gatorade would be your independent variable.*

A **dependent variable** is the thing or things you measure in order to determine if your hypothesis is correct. It should relate to your hypothesis in some way. *In the example above, you might measure radish height, rate of growth, weight, etc.* You can have multiple dependent variables, but they need to relate to your hypothesis.

What is your independent variable? _____

What is your dependent variable(s)? _____

7. Every good experiment has a **control**. A control is simply a part of your experiment that does not receive any treatment. Whenever possible, we include a control so that we have something to compare to. *In the example above, if your untreated radishes in your control grew as tall as your radishes in your treated groups, we'd know that your treatment had no impact on radish height.*

In this experiment, what will be your control? _____



8. Before moving on, let's recap everything that we have covered. Re-write your question, hypothesis, and rationale below. You may need to update your hypothesis to include your dependent variables listed above.

Research Question: *We wondered if*

Hypothesis: *We hypothesize that*

Rationale: *We think this because*

9. After you complete your investigation, what do you expect to find? How will your treated sample be different from your control? Describe your predictions for the end of your experiment in the space below:

10. What materials will you need to do this experiment? Think of everything you will need from beginning to end to make this experiment work. Keep in mind you will also need to include the tools you will use to measure your dependent variable (rulers, scale, etc.).



11. How will you test your hypothesis? Every experiment should have a detailed **Methods** section. The methods portion of an experiment should be like a cooking recipe – it should provide all of the steps and materials needed to successfully replicate an experiment (just like a recipe provides all of the details needed to successfully allow you to create the same kind of dessert).

Provide all of the steps needed to make your experiment happen. Be sure to ask yourself, *“If I gave this to another person that is not in my group, could they create the exact same experiment with the exact same results?”*

You may not need all of the steps below. It is ok to leave them blank if you do not need them, but make sure you are not missing any important details!!! HINT: Start a rough draft on a separate sheet of paper before writing your steps below.

Step 1: _____

Step 2: _____

Step 3: _____

Step 4: _____

Step 5: _____

Step 6: _____

Step 7: _____

Step 8: _____

12. Prepare a presentation for your instructor. To do so, prepare a presentation. This should involve a handout, a slide presentation (such as PowerPoint or Google Slides), or some other kind of visual. In your presentation, address each of the following:

a. Introduction:

- i. Our research subject (the thing we are studying) is _____.
- ii. We are interested in this specific aspect of this subject: _____.
- iii. We are interested in this because _____.
- iv. The following details and facts from credible sources are important to understand in order to fully grasp what we are proposing to do in our work: _____.
 1. *Cite all your sources using parenthetical citations (Author Last Name, Year)*
 2. *All these sources should also be cited in your Works Cited section.*

b. Overview Statement:

- i. Our broad overall goal is to _____.
- ii. Our specific objective is to _____.
- iii. Our hypothesis is _____.
- iv. We developed this hypothesis in response to _____.
- v. The rationale for this hypothesis is _____.
- vi. This work could improve our understanding of _____ because _____.
- vii. This work is significant because _____.
- viii. We believe this work is both feasible and worth funding because _____.

c. Needed Materials & Summary of Methods

d. Expected Findings (with specific reasons for why you expect to obtain these particular findings)

e. Conclusion & Summary of Key Points

f. Works Cited

- i. Include all references that are parenthetically cited in this presentation.
- ii. Use APA Citation: Last Name, First Initial. (Year). Title of document. *Publication*.

For example:

Kohn, C. (2018). The development of a bioenergy-based green chemistry curriculum for high schools. *Physical Sciences Reviews*, 4(1), 80.



Your presentation will be assessed using the following criteria:

Item	Plus (100%)	Check (70-90%)	Redo (0%)
Accuracy	No errors were detected in this presentation	This presentation contained a few errors, but overall was very accurate.	This presentation contained considerable errors.
Thoroughness	No important information was omitted.	A few more details would have enhanced this work.	Major topics were omitted that should have been included.
Professionalism	This presentation could be effectively delivered to a group outside of the school.	This is acceptable work for high school students but it could potentially be better.	The professionalism of this group needs improvement.
Group Involvement	Every member was involved with the development of the presentation as well as its delivery.	At least one more group member could have been more involved.	Multiple group members could have been more involved.
Effort	Effort exceeds what would be expected of a high school student.	Effort is acceptable for a high school student but it could potentially be better.	Level of effort could have been much greater than what was presented.
Feasibility	This proposal is completely feasible for the constraints in time, funding, resources etc. within this classroom.	This proposal creates some challenges but could be conducted with some additional effort.	This proposal is not feasible for the constraints in time, funding, and resources of this classroom.
Quality of Inquiry	This proposal addresses a completely novel question. This work would improve our understanding of a specific phenomenon or subject.	While this proposal addresses a question that is largely understood, it would expand our understanding for a specific context and is worth considering.	This proposal presents something that already well understood and its outcome is predictable.