

**Welcome** to the Science Research Program at Livingston High School. Congratulations on your acceptance into this exciting and innovative program of study. As you know by now, this course is a three-year science elective aimed at providing you with the opportunity to conduct your own research.

This summer will be the start of your journey. You will complete both a “reading” and an “experimental” assignment. These are meant to help you begin to learn how to dissect a science article, and to help you to start thinking about and working with a topic that you would like to research. There are so many interesting fields of study and so many interesting research projects going on at this very moment all over the world.

**This assignment is due the first day of school – NO EXCEPTIONS.**

*Remember, you only get one chance to make a first impression!*

### **READING Assignment**

#### Science Research Articles

a) **Articles to read.** The world is full of fascinating things to research. You will choose a total of five articles, all of which must be research-based. The articles may be on any topic that you choose, from aeronautics to bioinformatics to neuroscience to water quality to design; however, you must have one that focuses on each of the following:

- |                            |                           |
|----------------------------|---------------------------|
| i) the biological sciences | iii) the environment      |
| ii) the physical sciences  | iv) technology and design |

b) **Sources of articles.** To start your search for articles of interest to you, try exploring some of the sites below. Although, the articles and stories you find on these sites are not the primary, peer-reviewed research articles, each has a reference or link to the primary academic source at the end of the article. If you find a topic really interesting, try reading and outlining the primary research article as well, and incorporating that into your article summary. Make sure you find research-based articles from an accredited source - no “National Enquirer”, teen journals, etc.

- [Scientific American](#)-. Scientific American has news, articles, videos, podcasts on ALL areas of science. Make sure you find and read the article and not just a summary of it. You can access Scientific American through the [LHS Media Center's](#) online databases; go to Flipster to find SciAmerican. You can also buy hardcopies of SciAm magazines.
- [Science News](#) and [Science News for Students](#): latest reporting on science topics. Each report has links to additional supporting information and citations to the original research articles.
- [Science Daily](#) - current news, articles, videos, images and books on ALL areas of science. Each report has links to additional supporting information and citations to the original research articles.
- [Phys.org](#) - searchable site with easy to understand science news in ALL areas of science
- [LHS Media Center's Online Databases and eBooks](#) - Explore to find articles and other resources in addition to those listed above. (You must use your LHS account to access the media center).
- In addition to the sites above, feel free to find articles in your own ways.

If you find something of interest on the sites above, don't just read the short summary. Rather, click on all the links in the site, read the information, watch the videos, find the substantial research-

backed article (you should be able to identify the parts of the scientific method in the article) and **synthesize all the information you read for your article summary.**

- c) **Summarize article and accessory information.** Read and summarize each article according to the [Article Summary Sheet](#) (linked here and on the last page). The summary should be in your own words, not phrases quoted from the article. Copy the Article Summary Sheet to a new file and use it to summarize each article. You will need more space below each section so add extra space below each section for your summary (or staple extra pages if you hand write). To fully understand each article, read any embedded links, videos, and associated information. If there are vocabulary words or concepts that you do not understand, list them at the end of each Article Summary and **LOOK THEM UP!** Make notes for the word list as you see necessary. From each article, determine if it is a topic that interests you.
- d) Place all five articles with their summaries in a manila folder, marked with your name and student ID.

### **EXPERIMENTAL Assignment**

- a) Being guided by the **strategy on the next page**, select a topic of interest to you, and design an experiment. Then, choose a timeframe and conduct your first “experiment”.  
**IMPORTANT NOTE: DO NOT COPY an experiment you find on the web. You can use existing experiments as inspiration or as a starting point, but you must make the work your own by changing something.**  
Have fun with this. Explore something you are interested in, go outside, make observations and take measurements.
- b) Write up your experiment and results in a formal report. You should write it in the standard format of a lab report:
- i. Title: A statement relating the independent and dependent variables in the experiment.
  - ii. Objective: The purpose of your data collection.
  - iii. Procedure: Include a clear diagram or picture of your experimental setup. In a numbered list, clearly document your procedure including how you measured each variable and with what instrument.
  - iv. Data: Organize and present your data in a well-labeled data table. Include controls.
  - v. Analysis: The relationship between the variables you studied should be shown graphically (scatter plot or histogram/ bar graph). Include a paragraph or two to take the reader through what is on the graph and what it means.
  - vi. Conclusions: Summarize your results and discuss conclusions. Support your statements with quantitative evidence from your findings. Think about and discuss possible explanations for your results. Think about and discuss any unaccounted for factors that could have affected your dependent variable.
- c) Print and staple your experimental report, and place it in the manila folder marked with your name and student ID.

**Be prepared to discuss your summer research with your peers upon your return to school in September.**

How to Design an Experiment	Example 1	Example 2																																		
1. What topic am I interested in studying?	Plants	Rockets (can't study real rockets, but can make and study a model: bottle rocket)																																		
2. Within my topic, what two <u>VARIABLES</u> can I manipulate and measure? <ol style="list-style-type: none"> <li><i>Dependent variable</i>: Is there a specific property or variable that I can examine within that topic?</li> <li><i>Independent variable</i>: What variable affects the dependent variable? Choose one that you can manipulate</li> </ol>	<i>Growth of Plants</i> and Fertilizer type <i>or</i> water amount <i>or</i> soil <i>or</i> light exposure <i>or</i> light color ...	<i>Peak height of a water rocket</i> and Amount of water (fuel) in rocket <i>or</i> launch pressure <i>or</i> type of fins <i>or</i> rocket mass, ...																																		
3. Design experimental <u>PROCEDURE</u> to investigate the <u>objective</u> of finding how the <i>independent variable</i> affects the <i>dependent variable</i> . In other words, you will change the independent variable and measure its effect on the dependent variable. <u>Procedure</u> : <ul style="list-style-type: none"> <li>Setup: Make a diagram or pic; label with measured variables. Describe the setup</li> <li>You should collect <u>at least 6 different data points</u> by changing the indep variable to at least 6 different values and measuring the effect of each on the dep variable</li> <li>You must decide and document <u>how</u> you will measure each variable and <u>with what measuring instrument</u>.</li> <li>You must run your experiment under <u>controlled</u> conditions. In other words, only the indep variable should be changed; all other conditions should be kept constant and documented. If something other than the indep variable is changed, then you will not know the effect of your indep variable.</li> <li>You should <u>repeat each measurement at least three times</u> because no measurement is exact. Take the average of your repeated measurements.</li> <li>Record data in a well-organized and logical <u>data table</u> (eg below):</li> </ul> <table border="1" data-bbox="167 1455 711 1675"> <thead> <tr> <th rowspan="2">Ind.Var (units)</th> <th colspan="4">Dep Var (units)</th> </tr> <tr> <th>Trial 1</th> <th>Trial2</th> <th>Trial3</th> <th>avg</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	Ind.Var (units)	Dep Var (units)				Trial 1	Trial2	Trial3	avg																										<u>Objective</u> : How will changing the <i>type of fertilizer</i> affect the <i>growth of a plant</i> ? <u>Procedure</u> : <ul style="list-style-type: none"> <li><i>Indep variable</i> – use 6 different types of fertilizer to grow a plant. <i>Dep Var</i> – measure the height of the plant after 3 weeks. Height measured from ground to peak with a ruler. <b>REPEAT</b> at least 3xs</li> <li><u>Controls</u>: grow same type of plant in same growing conditions (same soil, amount of water, light, heat).</li> </ul>	<u>Objective</u> : How will <i>amount of water</i> used to launch the rocket affect the <i>peak height</i> ? <u>Procedure</u> : <ul style="list-style-type: none"> <li><i>Indep variable</i> – Fill 2L bottle rocket with different volumes of water measured with a graduated cylinder. Collect 8 independent data points by using the following volumes: 300, 400, 500, 600, 700, 800, 1000, 1200ml. <b>REPEAT</b> at least 3xs  <i>Dep Var</i> – cant measure peak height, but can measure the <i>time it takes to peak height</i> from launch using a stopwatch.</li> <li><u>Controls</u>: use same rocket, same launch pressure, same launcher, same angle, same launch conditions (same day).</li> </ul>
Ind.Var (units)		Dep Var (units)																																		
	Trial 1	Trial2	Trial3	avg																																
4. How will I <u>ANALYZE</u> my data to show my results and make conclusions? Results are usually shown in a graph (scatter plot), bar graph, or histogram because that is the most concise and clear way to see the relationship between the independent and dependent variable. <i>The dependent variable</i> goes on the <i>y-axis</i> and the <i>independent variable</i> goes on the <i>x-axis</i> . Title the graph and label both axes clearly (including units).	Make a bar graph of the <i>plant height</i> (y-axis) vs the <i>type of fertilizer</i> .	Make a scatter plot graph of the <i>rockets time to peak height</i> (y-axis) vs <i>volume of water</i> (x-axis).																																		

## Other examples of possible experiments

- \* Does oil reduce *friction on a slide* the same regardless of what *type of oil* is used?
- \* A plastic bottle sitting on a surface will eventually tip over if it is slowly pushed at the cap. Is *the angle that it needs to tip* different for a bottle *full of water, a bottle full of sand, or a bottle of half sand/half water*?
- \* Do different *brands of paper towels* have different *absorbencies*?
- \* If a *bucket of sand and a bucket of water* are placed outside, will the *temperature* just below the surface of the sand and the water show the same variation over a 24 hour period?
- \* Is more *plant biomass* produced if a plant is grown in a higher *CO<sub>2</sub> environment*?
- \* Is it true that *photosynthesis* is halted at *temperatures* greater than 95 °F?
- \* Does the *width of a candle* affect the *rate that it burns*?
- \* For any particular species of tree, is there a relationship between the *circumference of the trunk* and the *circumference of the first branch*?
- \* If a small bouncy ball is dropped from *different heights*, is there a relationship between the *height of the first bounce* and the *height that it is dropped*?

If you have any questions or need any materials, please contact us.

Enjoy your summer!

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## Science Research I - Summer Assignment

Student	Total Points	Earned Points	Comments
_____			
Article summaries	40		
Article selection (bio, phys, enviro, tech/design)	8		
Personal research submitted in form of lab report	50		
Turned in 1 <sup>st</sup> day, in folder	2		
Total Points	100		

## Science Research Article Summary Sheet

*(add space below each section as needed)*

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Descriptive Title In Your Own Words** (replace this line with your own text)

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**Reference** (authors, year of publication, title of article, source of publication):

**Background (Introduction):** Summarize in clearly written paragraphs

**What was done (Methods):** List the methods, focusing on the big picture rather than the details.

**What was learned (Results):** List each result (in each figure/ section) beginning with a brief phrase that summarizes the bottom line result, followed by a short paragraph that provides and explains the evidence from the paper (claim, evidence, reasoning).

**What it means (Discussion):** Summarize in clearly written paragraphs