Science Project Packet
BJU Life Science

Detailed instructions on completing your science project

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Science Project – Life Science Class

Do not be overwhelmed by the size of this packet. Yes, you will be completing a large project with many components, but we will be breaking it up into manageable pieces with lots of guidance along the way. This packet is designed to be a resource and to give you a game plan. Take it one step at a time and you'll be amazed at how much you accomplish.

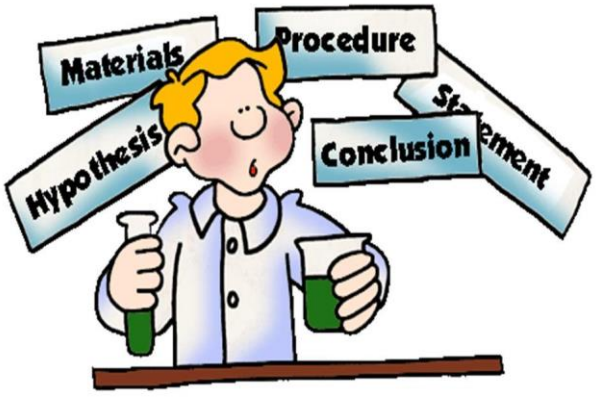
Each of the items listed on the following schedule is also listed on your class syllabus. In the following pages you will find detailed instructions for each section. We will also be discussing these items in class. As you submit each component, it will be given back to you with notes for improvement or suggestions to try. Since the science project counts as 20% of your grade during the last two quarters, you will want to be sure you submit all the required components.

All submissions should be type-written and labeled. You will be completing the project in sections but at the end, you will combine all the sections into one final paper. This will be much easier to do if all your information is stored in your computer (**and backed up somewhere** – a thumb drive is a GOOD investment!).

Wait to purchase your materials for your experimentation until after you have completed your research and finalized the design for your experiment. Many students find that they make several changes during this process.

You will be asked to give an oral presentation of your project just prior to summer break. You will create a tri-fold backboard to use in this presentation. If you like, you may go ahead and purchase the backboard, but I encourage you wait to put it together until after you have completed all your experimentation and come to your final conclusions.

Above all, have fun with the project. I can't wait to see what you come up with!



2023 Science Project Timeline

Your **Science Project** will include a science project (including research) paper, a scientific investigation (including hypothesis, experiment and observations), the interpretation of data, results, conclusions and real-life applications, an oral presentation, and a backboard display. All information will be submitted in a completed research paper (around 10-12 pages) and include an oral presentation to the class with a backboard display.

Jan. 18	***Idea Due; Research Begins*** Read *Choosing A Science Project Topic* – pg 5-6 You are to submit a piece of paper with your name and your topic choice. Tell me what question you are going to answer and tell me why you chose this topic. ("It looked easy." Or "It looked fun" are not good reasons.) This should be at least one good paragraph (5-8 sentences).
Jan. 25	***Submit at least 4 sources for your research.*** Read – *Science Project Research* – pgs 7-8 You are to submit a list of your resources (you will be submitting this in Works Cited format later). Remember – you will need to start with at least four sources – and not all from the internet. Wikipedia is not a valid source. Each student should strive to use several (3-5) book sources, maybe one encyclopedia source, maybe one (1-3) magazine source, and no more than 3 internet sources.
Feb. 6	***Submit 4 paragraphs on your research thus far,*** ***A Working Outline and*** ***Works Cited page (turn in a copy)*** Read – *A Working Outline*, *Note Cards*, *Four Research Paragraphs*, *Footnotes* and *Works Cited Page* – pgs 9-15 You are to submit four well-written paragraphs (5-8 sentences each paragraph) with footnotes on the research you have done thus far; include your working outline and Works Cited page – this time in proper Works Cited format.
Feb. 13	***Submit your hypothesis & paragraph explaining why*** ***Submit experiment design ideas (rough draft)*** Read – *The Scientific Method*, *Your Hypothesis* and *Designing Your Experiment* – pgs 16-20 Write a paragraph (5-8 sentences) containing your hypothesis. And, on a separate piece of paper write out the details of your experiment. Be sure to label both papers.
Feb. 20	***Submit 2 pages of research, Working Outline, and Works Cited page*** Read – *Two Pages of Research*, *Revision Checklist* and *Editing Checklist*– pgs 21-22 Submit two full pages with footnotes on the research you have completed about other scientists and their work in the area of your project. Include your working outline.

Feb. 27	***Formal submission of experiment design*** ***Experimentation begins at home*** Read – *Formal Submission of Experiment Design* *and* *Experimentation* – pg 23 Submit the formal write-up of your experimentation process. This can still be tweaked as you work through your experiment, but be as detailed and as accurate as possible. Begin working at home on your experiment, tracking results as you go.
Mar. 19	***One paragraph introducing your project*** Read – *Introductory paragraph* – pg 24 Submit a well written paragraph (5-8 sentences) introducing your project. Hook your reader.
Mar. 26	***Bring in experimentation results to date*** Read – *Experiment Results* – pgs 25 Submit your data to date and if you're ready, go ahead and design a chart to help explain your data. By the way – this chart will also be going on your backboard.
Apr. 9	***Write up your final experiment results. Include tables/charts/graphs, etc. Write your conclusion and real-life application.*** *Read Final Experiment Results and Interpretation* and – *Conclusions and Application* - pg 26 Submit your final experiment results **with paragraph summary**, data table, charts and graphs. Also write your conclusion and whether your hypothesis was correct. Finally add **at least two paragraphs** (5-8 sentences each paragraph) telling how your results can be used in real life.
Apr. 16	***First Draft of Final Paper*** Read - *Science Project Paper, Research Paper Checklist* – pgs 27-30 Note – there are sections added to the paper that have not been discussed yet. They are quite easy to add. Just follow the instructions. Most sections have already been completed, so it's just a matter of cutting and pasting, then checking to be sure the paper flows well. ***IT IS IMPORTANT THAT YOU SUBMIT THE DRAFT ON TIME!*** I will be doing one last read-through and adding notes. I want to be able to return the paper to you as soon as possible so that you can complete your final copy. After that, you will only have one week to turn around the final copy. Please do not e-mail it to me. I need the hard copy.
Apr. 30 Apr. 30 May 2	***Final Paper Due – NO EXCEPTIONS!!*** *Group A Oral Presentations with backboard* *Group B Oral Presentations with backboard* Read – *Science Project Backboard Design*, *Science Project Backboard Checklist* and *Oral Presentation*– pgs 31-34 **Because we begin presentations – ALL papers must be submitted today. No late work will be accepted. Your backboard will not be submitted until the day of your presentation.**
May 7 May 9	*Group C Oral Presentations with backboard* *Group D Oral Presentations with backboard*

See page 35 for a copy of the final scoring sheet.

Choosing a Science Project Topic

- Choose a topic in which you are interested. Do you want to experiment with food, plants, chemicals, or something else? You will spend two whole quarters on this project, so make it interesting and fun.

- Ask a question. What is it you want to discover? Do you want to compare products? Are you interested in what makes plants grow taller? Why is it that your dentist tells you not to drink soda? This is NOT a demonstration – this is a fact-finding mission.

- Choose a topic with which you are somewhat familiar.

- Choose a topic that will interest your audience.

- Choose a topic that is specific.

- Choose a topic for which you can find adequate information – good research. It is probably something that has already been done and documented. The research portion of your paper will take up at least two or three pages. You want to be sure you can find enough information to adequately make your point. Your research will be completed *before your start your* experimentation.

- Choose a topic that has a real-life application. Once you have conducted your project, you must be able to tell how the information you learned can be used.

- Choose a topic that lends itself to experimentation.

- Try to think of the cost, materials and time needed to do the experiment. Be sure it is something you can do within the semester.

- Check out your local library! Most science subjects can be found in the 500-599 range of the Dewey decimal system. Specifically, 507.8 in the Dewey decimal system will have science fair project books with lots of ideas!

- Look on the Internet for projects that have been done in the past: California State Science Fair www.usc.edu/CSSF/ or Science Hound: All Science Fair Projects www.all-science-fair-projects.com

- Visit www.sciencebuddies.org This website has a feature called "Topic Selection Wizard," which lets you answer questions about your interests and then matches you with possible science fair topics.

Submitting your Science Project Topic

Topic should be submitted on a piece of paper with your name. Tell what question you plan to answer and why you chose this topic. ("It looked easy." Or "It looked fun" are not good reasons.) This should be at least one good paragraph (5-8 sentences).

- Phrase your topic in question form. (NOT a question with a yes/no answer).
- Phrase your topic clearly and concisely.
- Paragraph should discuss why you chose the topic.
    - ♦ Have you played with something to do with this topic before?
    - ♦ How do you see your topic in use in the world? Is that what interests you?
    - ♦ Does someone you know do something with this topic and you want to join them?
- Do NOT discuss what you will do for your experiment.
- Don't forget your name!

Examples of Science Project Topics

POOR	BETTER
Blood	How is blood typed? How does blood circulate through the body?
Plants	Can water loss in a plant be measured? How does a tree grow?
Arthropods	How do ants find their way? How do grasshoppers react to light?
How can snow stay frozen?	Which type of material makes the best container to keep snow from melting?
What color is an earthworm?	How does an earthworm react to light and darkness?

Science Project Research

Before a science experiment can be designed and performed, research must be conducted. The research paper should answer at least these questions:

- What scientists have done similar research?
- What experiments have been or are presently being performed?
- What were the results?
- What scientific principles apply to your project?

A science research paper is a well-organized composition. It contains information derived from study and reading, and is a blend of the writer's thoughts and ideas with thoughts and ideas of the authors he reads. It is the result of a careful investigation of a scientific topic and presents the findings of the researcher in a theme.

You will **write at least two pages** on someone else's research for the subject you have chosen. You will also formulate your hypothesis based on what you learn from your research.

As you research, be sure to narrow the scope of your project. "Do plants grow taller in light or dark?" is too broad of a question. You need to identify a specific plant as well as the type of light you will be working with.

Each student should strive to use several (3-5) book sources, maybe one encyclopedia source, maybe one magazine source (1-3), and no more than 3 internet sources.

Keep a list of ALL the sources you use. Start building your Works Cited page for your paper with this information. Follow the instructions on your "Works Cited (Bibliography)" information page – or go to http://owl.english.purdue.edu/owl/resource/747/01/ It is also okay with me if you use a Bibliography (Works Cited) creation website such as easybib.com.

You are to submit a list of your resources shortly after you decide on a project topic – then you will resubmit the list as a Works Cited page a few weeks later. Remember – you will need to start with at least four sources – and not all from the internet.

You will continue to add to this list as you work on your project and find that further research is required. Your official Works Cited first draft is due later in the month.

Read through your resources carefully and take good notes on information that is relevant to your project.

A Note on Internet Sources:
Be AWARE: the Web is huge and anyone can post anything online. Not all sites have accurate or up-to-date science facts. It is **your responsibility** as a researcher to make sure that the information you find is reliable. The URL address will help you determine if a source is reliable. Domain types .edu (educational) and .gov (government) will be much more reliable than domain types .com (commercial), .org (organization), and .net (network). These last three sites are unrestricted, meaning anyone can create them.
Specifically, Wikipedia is **not** a valid source as it is Open Source meaning that anyone can post any information they want. However, if you look at the bottom of a Wikipedia article on your subject, you may use any sources listed there to aid in your research.
In addition, blogs are **not** a valid source as they are opinion pieces.

A Note on Finding Magazine Articles

You can search your public library databases for magazine articles using the internet. From the Library Home Page, click on 'Digital Library' tab. Click on 'Flipster.' On the left-hand side, click on 'Science & Technology' under categories. If you know the magazine you are looking for, click on it. If you don't know the magazine you are looking for, click on one that interests you. Once you have selected a magazine, click on the magnifying glass icon in the upper right to type in a key word about your topic. Be sure to select 'All Issues' tab. Several articles will appear with your key word highlighted. Select and read the article of your choice.

The following directions are given by our PEP Comp & Lit tutors for their research papers.

Duval County Public Library:
∗Follow this link: https://jaxpubliclibrary.org/masterfile-premier-ebsco
∗Select "Go to Resource"
∗Enter your library card number (FJP_____)
∗Go to Advanced Search
∗Check boxes for "Full Text," "Peer Reviewed," and "PDF Full Text"
∗Enter search terms in box (Photosynthesis, for example), click Search
∗Numbered Results list will generate, click title to view abstract (summary)
∗PDF Full Text to download to computer
∗Tool bar on right allows you to print, save, email, download, and **Cite button: gives correct citation**, look for MLA, copy and paste to Word doc
∗Return to list to view additional sources
∗Can also select "Academic One File" for the Gale Academic Database (see directions below for St. Johns as it is the same database.)

St Johns County Public Library:
∗Follow this link:
https://galeapps.gale.com/apps/auth?userGroupName=23414_sjcpl&origURL=https%3A%2F%2Fgo.gale.com%2Fps%2Fi.do%3Fv%3D2.1%26u%3D23414_sjcpl%26pg%3DBasicSearch%26it%3Dstatic%26sw%3Dw%26p%3DGPS&prodId=GPS
∗Enter your library card number, sign in
∗Go to Advanced Search, enter terms (Photosynthesis, Phototropism, etc)
∗Choose "Documents with full text" and "Peer-reviewed journals"
∗Choose "Article" for Document Type
∗Search
∗Select title to view, read
∗Watch for book reviews—this is not a source, but could point you to a source
∗Top bar allows you to download, print, cite, email, can even have text read to you with the "listen" icon
∗Return to list to view additional sources

A Working Outline

- A working outline can be changed as necessary.
- A working outline will eventually become the final outline for the research paper.
- It is designed to aid you as you gather information. (It should help you avoid reading and taking notes on material which really does not apply to your paper.)
- Read a good encyclopedia to get a quick sketch of the topic.
- Arrange the material in a logical pattern.
- A good outline requires at least three main points (I, II, III).
- A good outline requires at least two sub-points for each main point (A, B).
- An outline is not written in sentence form, but should be topical.
- The periods after the Roman numerals of main points must be lined up under each other.
- Every first word of main points should be capitalized.
- The periods after the capital letters of sub-points must be lined up under each other.
- Every first word of sub-points should be capitalized.
- Formatting an Outline in Microsoft Word (link available on my weebly page)
- Formatting an Outline in Google Docs (link available on my weebly page)

Sample Working Outline:

Reaction to Light by Plants

I. Why they bend
   A. Photosynthesis defined
   B. Photosynthesis needs
II. How they bend
   A. Affected by leaf arrangement
   B. Petiole moves
   C. Phototropism
III. Early phototropism experimenters
   A. Darwin
   B. Boysen-Jensen
   C. Went
IV. Natural or artificial light

Note Cards

- Make sure you have completed a bibliography card for each source you select. Example bibliography cards can be found in "Works Cited (Bibliography) Page" under "Sample Bibliography Cards."

- Make several note cards for each sub-topic category from your working outline. Write the names of the sub-topic categories at the top of the cards. (Shoot for at least 8 cards for each sub-topic.)

- As you read, record one idea, thought, or piece of information that seems important per note card. The notes you take on each note card must support the topic/sub-topic category written on that note card. The topic/sub-topic categories will help you be selective in your reading and will organize your note-taking.

- Keep in mind that you may want to revise your working outline and change your topic categories as you see what information is available. Your working outline must be flexible because it will usually go through changes as you determine the direction of your report as you gather more information.

- At the bottom of every note card, write the title of the source (or bibliography card number) and the page number you have used.

- Four things characterize a good note card:

  1. It contains the working bibliography card number.
  2. It has a word or phrase from the sub-topic category from your working outline to indicate where the information belongs in your research paper.
  3. It contains a summary or direct quote of the material. Only one idea per note card.
  4. It includes the page number from which the notes are taken.

You should strive to use 8 notecards per sub-topic (A. B. C. etc.) in your paper. Every student should strive to have at least 50 note cards.

Then, any time you use a notecard for your research, you need to footnote it in your paper. This means almost every sentence in the body of your paper will have a source cited unless you are doing original research.

Four Research Paragraphs

Now that you have had time to read about (and take notes on) other people's research, you are ready to start your research paper. ***Submit the start of your research section in the form of four well-written paragraphs (5-8 sentences each paragraph).*** You will submit an introductory paragraph later, so these four paragraphs are all just research.

You may have discovered that not all the resources you gathered contained an abundance of information on your topic. If not, it's time to expand your research. Even if the original sources are all good, continue to add to your investigation. The more information you have to work with, the easier it will be to write your paper and design a workable experiment.

It is also possible that by now you have discovered that this is not really the project topic you were hoping that it was. Now is a good time to change topics if you'd like. Just keep me posted on what you're doing. If you're changing topics, you will need to submit an updated list of resources along with your four paragraphs.

- The purpose of the four research paragraphs is to transfer your notes from note cards to correct outline form.
- When typing, use 1" margins (top, bottom, left and right) and double space.
- Use Times New Roman, Calibri or Arial font – size 12.
- **This is a formal research paper. Please avoid using first person pronouns (I, we, my, me) and second person pronouns (you, your). Do not use contractions. Be aware that the informal way you may speak or say something will need to be worded in a more formal manner and/or a more scientific manner.**
- Include quotations and other material for which you need to give another author credit. Use footnotes to do this. Follow the instructions on your "Footnotes" page.
- Avoid using first person and second person personal pronouns (I, me, we, you).
- Do not use contractions.
- Avoid casual remarks you would use when speaking ('hard to come by,' 'down the line,' 'for a while.')

You are to submit four well-written paragraphs (5-8 sentences each paragraph) with footnotes on the research you have done thus far; include your Working Outline and Works Cited page – this time in proper Works Cited format.

See the next two sections for information on footnotes and on citing your sources.

Right now we are only asking for four paragraphs of research. Ultimately, you will know you've done enough research if your paper is **2-3 pages typewritten** (double spaced, 12 point font Times New Roman, Arial or Calibri). (Minimum five paragraphs.) Please number the pages of your rough draft – upper right corner.

Footnotes

Credit is always given for work contributed by someone else. Using someone's work without proper credit being given is plagiarism. It is a form of theft.

Plagiarism defined by the *American College Dictionary* is "copying or imitating the language, ideas, and thoughts of another author and passing off the same as one's original work." It involves the copying of the exact language of someone else without giving proper credit to the original author. To change a few words is not sufficient. A **complete** rewording is necessary to avoid plagiarism. It is also necessary to **rework the order** of ideas and thoughts. Your organization of information should be original. To steal someone's organization (order) of ideas and thoughts without giving him credit is also plagiarism.

In a research paper you are not expected to come up with and discuss original ideas. Your task is to collect and organize information. The proper way to give credit for information obtained from someone else's writing is by footnotes. A good paper abounds with footnotes from many sources. If you quote the author directly, you should also enclose the information in quotation marks. At the end of the information you are crediting, put a one- or two-word citation within parentheses. You will give complete resource information at the end on your Works Cited page.

- Always footnote direct quotes.
- Footnote any information that is not general knowledge.
- Each time you wish to give credit to an author, write down his last name and the page number from which the material came. Place parentheses around the entry. It should be placed at the end of the sentence, before the period of the sentence (Jones 32).
- If you use a source that does not have an author, pick a few words that will easily identify your source. Ex. (Jet Propulsion Laboratory).
- If you have more than one source from the same author, add more identifying information within the paper. Ex. (Alexander, March 2008).

Sample Footnotes:
"Photosynthesis is a food-making process that occurs in green plants" (Jones 382).
Photosynthesis 'runs' on sunshine with sugar as its product. The sugar is changed into protoplasm (Martin 28).

Works Cited (Bibliography) Page

A works cited page (bibliography) is a collection of books, magazines, and other source materials that contain information about your topic. The information is typically written on 3x5 inch index cards while you are researching and taking notes from a source.

Each student should strive to use several (3-5) book sources, maybe one encyclopedia source, maybe one magazine source (1-3), and no more than 3 internet sources.

You may use a Bibliography (Works Cited) creation website such as easybib.com.

You may use the *Bedford Handbook, Writer's Inc.*, or any other good resource that you have to help you cite sources.

Note – the majority of this information is taken from The OWL (Online Writing Lab) at Perdue: Purdue OWL // Purdue Writing Lab

Basic Rules

- Begin your Works Cited page **on a separate page at the end of your research paper**. It should have the same one-inch margins and last name, page number header (upper right corner) as the rest of your paper.
- Label the page Works Cited (do not underline the words 'Works Cited' or put them in quotation marks) and center the words Works Cited at the top of the page.
- Double space all citations, but do not skip spaces between entries.
- Indent the second and subsequent lines of citations five spaces so that you create a hanging indent. *You'll find 'hanging indentation' as one of your options for paragraph formatting in your Word program.*
- List page numbers of sources efficiently, when needed. If you refer to a journal article that appeared on pages 225 through 250, list the page numbers on your Works Cited page as 225-50.

If you're citing an article or a publication that was originally issued in print form but that you retrieved from an online database, you should provide enough information so that the reader can locate the article either in its original print form or retrieve it from the online database (if they have access).

Capitalization and Punctuation

- Capitalize each word in the titles of articles, books, etc., but do not capitalize articles, short prepositions, or conjunctions unless one is the first word of the title or subtitle: *Gone with the Wind, The Art of War, There is Nothing Left to Lose*.
- Use italics or underlining for titles of larger works (books, magazines) and quotation marks for titles of shorter works (poems, articles)

Listing Author Names

Entries are listed alphabetically by author last name (or, for entire edited collections, editor names). Author names are written last name first; middle names or middle initials follow the first name:

Burke, Kenneth
Levy, David M.
Wallace, David Foster

Do not list titles (Dr., Sir, Saint, etc.) or degrees (PhD, MA, DDS, etc.) with names. A book listing an author named "John Bigbrain, PhD" appears simply as "Bigbrain, John"; do, however, include suffixes like "Jr." or "II." Putting it all together, a work by Dr. Martin Luther King, Jr. would be cited as "King, Martin Luther, Jr.," with the suffix following the first or middle name and a comma.

More than One Work by an Author

If you have cited more than one work by a particular author, order the entries alphabetically by title, and use three hyphens in place of the author's name for every entry after the first:

Burke, Kenneth. *A Grammar of Motives*.

---. *A Rhetoric of Motives*.

When an author or collection editor appears both as the sole author of a text and as the first author of a group, list solo-author entries first:

Heller, Steven, ed. *The Education of an E-Designer*.

Heller, Steven and Karen Pomeroy. *Design Literacy: Understanding Graphic Design*.

Work with No Known Author

Alphabetize works with no known author by their title; use a shortened version of the title in the parenthetical citations in your paper. In this case, *Boring Postcards USA* has no known author:

Baudrillard, Jean. *Simulacra and Simulations*.

Boring Postcards USA.

Burke, Kenneth. *A Rhetoric of Motives*.

Additional Sources

For information on citing Books, go to MLA Works Cited Page: Books // Purdue Writing Lab

For information on citing Periodicals, go to MLA Works Cited Page: Periodicals // Purdue Writing Lab

For information on citing Electronic Sources, go to MLA Works Cited: Electronic Sources // Purdue Writing Lab

Sample Bibliography Cards

Sample Bibliography Card – Encyclopedia
Author's name – last name first (found at either beginning or end of article). "Title of Article." *Title of Encyclopedia*, edition date.

Calvin, Melvin. "Phototropism." *World Book Encyclopedia*, 2012 ed.

Sample Bibliography Card – Book
Author – last name first. *Book Title*. Publisher, year published.

Reid, Keith. *Nature's Network*. The Natural History Press, 2000.

Sample Bibliography Card – Magazine
Author – last name first. "Title of Article." *Name of Magazine*, day month year, and page numbers of the entire article in a magazine (not just the page you used).

Juarez, Ricardo. "The Basics About Phototropism." *America's Plants,* 20 May 2010, pp. 68-69.

Sample Bibliography Card – Internet source
Author's name (sometimes not given). "Article Name." Title of web page. Date. URL of web page.

Jones, Robert. "Gravitropism." *Nature*. 28 Dec. 2011. www.naturewebsite.net

Sample Word from Dictionary – Internet source
Word in quotes. Title of Dictionary, author, URL of web page.

"Parting." *Merriam-Webster.com Dictionary*, Merriam-Webster, https://www.merriam-webster.com/dictionary/parting. 26 Apr. 2020.

All information and suggestions on a science fair project are taken from an A Beka Book entitled A Science Project by DeWitt Steele. Checklists have been copied with permission. Details on preparing a research paper are taken from The Shurley Method: English Made Easy, Level 7 by Brenda Shurley.

The Scientific Method

1. Make a Hypothesis: now that you've done some research to answer your initial question, you are ready to make a hypothesis – an educated guess.
2. Design an Experiment: design an experiment that will give results that answer your initial question.
3. Collect and Record Data: make careful observations and record exactly what happens.
4. Display and Understand Results: organize your data into graphs, charts, tables, or diagrams. A picture can help you read all your data and figure out what it means.
5. Make a Conclusion and Answer your initial Question: did your data prove your hypothesis? Share your results with others.

Your Hypothesis

After thoroughly researching your question, you should have some educated guess about how things work. What did you learn during your research that could answer your project question? This educated guess about the answer to your question is called the **hypothesis**. It should stand alone. **In addition, you will then write several sentences about what you expect to observe after you have conducted your own experiment. Be sure to tell why you expect to see these results.** We will be expanding this to a full paragraph as we work on completing your paper – so the more information you have now, the better.

A hypothesis is a prediction that can be tested. In the end, it doesn't matter if your hypothesis is correct or not. What matters is that is sets you in the direction of discovery. **The hypothesis must be worded so that it can be tested in your experiment. Do this by expressing the hypothesis using your independent variable (the variable you change during your experiment) and your dependent variable (the variable you observe changing due to changes in the independent variable).** In fact, many hypotheses are stated exactly like this: "If a particular independent variable is changed, then there is also a change in a certain dependent variable." (If you cannot identify your independent variable and dependent variable, go back to your topic submission assignment. I wrote them down for you.)

- A hypothesis is an educated guess about how things work.
- Most of the time a hypothesis is written like this:
  "If _____[I do this]_____, then ___[this]_____ will happen."
- Your hypothesis should be something that you can actually test, what's called a testable hypothesis. In other words, you need to be able to measure both "what you do" and "what will happen."

Example Hypotheses:

Hypothesis: If the faucet is opened [faucet opening size is the independent variable], then it will increase the flow of water [flow of water is the dependent variable].

Explanatory paragraph – what you expect to observe and why.

Hypothesis: Raising the temperature of a cup of water [temperature is the independent variable] will increase the amount of sugar that dissolves [the amount of sugar is the dependent variable].

Explanatory paragraph – what you expect to observe and why.

Hypothesis: If a plant receives fertilizer [having fertilizer is the independent variable], then it will grow to be bigger than a plant that does not receive fertilizer [plant size is the dependent variable].

Explanatory paragraph – what you expect to observe and why.

Note: When you write your own hypothesis you can leave out the part in the above examples that is in brackets [ ]. Remember to avoid first person pronouns (I, we, my, me) and second person pronouns (you).

Notice that in each of the examples it will be easy to measure the independent variables. This is another important characteristic of a good hypothesis. If we can readily measure the variables in the hypothesis, then we say that the hypothesis is **testable**.

Not every question can be answered by the scientific method. The hypothesis is the key. If you can state your question as a testable hypothesis, then you can use the scientific method to obtain an answer.
All information and suggestions on writing a hypothesis were taken from http://www.sciencebuddies.org/science-fair-projects/project_hypothesis.shtml#examples

Designing Your Experiment

Before you start with the fun stuff, i.e. the actual hands-on experiment, you will need to write your plan out on paper. But first, it might be helpful to discuss what a scientific investigation is and how to perform it.

Investigation

A scientific investigation is a long-term endeavor that typically involves: observation, experimentation, and statistical study. A scientific investigation is the use of the scientific method to investigate and illustrate a particular phenomenon of the natural world. A scientific investigation is 1) carefully planned, 2) involves solving a specific problem or answering a particular question, 3) requires constructive thinking and specification, and 4) seeks to pose and answer a definite question.

Observation

A scientific observation involves more than just passively watching something happen. One may begin by listing characteristics or properties that may be sensed with the senses, but observation goes further to involve careful study that attempts to find the answers to questions such as "What is happening? What are the relationships between certain variables? And how is this phenomenon taking place?" Scientific observation leads to further questions and to ideas of what can be done experimentally to answer these questions. Therefore, scientific observation 1) is the accumulation of data by actually observing events or behavior, 2) is made under natural conditions, and 3) usually involves an observer who observes without the subject being aware he is being observed.

To make accurate observations, make the observations at the same time each day. If your experiment is fast, you may make observations every hour or every 10 minutes. Another way to make accurate observations is to make observations under the same conditions (measure plant growth one hour after watering). It is usually helpful to record your observations in a table. This helps you remember to record the same data each time you make an observation.

Experimentation

A scientific observation naturally leads to scientific experimentation. In experimentation, phenomena are studied in a controlled situation (an experiment) in which as many conditions as possible are dictated and determined by the experimenter. By studying various aspects, or variables, in a phenomenon one at a time in a controlled environment and under specified conditions, the experimenter hopes to obtain answers to questions or tentative explanations (hypothesis) that he 1) is the testing of an idea to determine its validity, 2) is demonstrating the truthfulness of some known fact, and 3) is conducting of tests. Experiments are validated by controls and all experiments must have a control. Controls are necessary to the experiment because they show what would happen in a given situation if the experiment had not been performed.

One type of experiment looks at what something does when it is treated in different ways. Another type of experiment looks at what different things do when treated the same way. A variable is something that can change. An independent variable is one changed by the scientist (i.e. different light colors to affect plant growth, or different liquids to put chalk into to dissolve). A dependent variable is something changed by the independent variable (i.e. plant height affected by different light colors, or the time it takes for chalk to dissolve depending on what liquid it is placed in).

One sample (the thing on which you are experimenting) is not enough. Several samples are needed to compare if they all change in the same way (i.e. two or three plants placed under the same color light). A control is a sample with no independent variable (a plant placed under sunlight instead of red or blue light, or chalk placed in water instead of vinegar or lemon juice).

Statistical Study (Data)

Once facts have been gathered, this data needs to be analyzed for its reproducibility (can it be repeated with the same results) and then interpreted in terms of the posed questions and hypotheses. A scientific statistical study seeks to determine whether the data obtained in the experiments are legitimate. Legitimate data (can be obtained repeatedly under the same conditions, not an anomaly or 'fluke') must be interpreted in light of the experimental conditions as to what they indicate concerning the phenomenon under study. Graphs and charts showing relationships observed in the experimentation are a part of the statistical study. These are simply methods of presenting in a pictorial form the data that was obtained. A statistical study 1) is counting something, 2) is analyzing the information derived and making a general statement concerning the information, and 3) may be a comparison of numerical information. Most students conduct a series of experiments for their science projects; usually, **a single experiment proves to be unsatisfactory**.

A table is a useful way to record your date, but a graph can give you a better picture of what happened. A graph is an information picture and is easy-to-understand. A graph can help you 'see' trends and patterns in your data. You may use a bar graph to show the height of plants or a line graph to show multiple data taken at the same time (temperature taken in four different places at the same time).

It is not enough to draw a graph. To complete your scientific investigation you must interpret, or figure out, what the graph is telling you. For example, plants growing in sunlight grow faster and taller than plants in red or blue light. You can then compare your interpretations to your hypothesis to draw a conclusion.

Conclusion

A conclusion is where you determine what your experiment shows. Was your hypothesis correct? If not, no big deal. What *does* your data prove? Every experiment done properly will always prove something – maybe not what you hypothesized, but something.

Remember to avoid first person pronouns (I, we, my, me) and second person pronouns (you).

All information and suggestions on a science fair project are taken from an A Beka Book entitled A Science Project by DeWitt Steele.

Back to Designing your Experiment

Remember your experiment is NOT a demonstration – this is an experiment to test something. You will have asked a question and now you need to determine how to get an answer to your question. For example, which battery is longer lasting, or how fast will chips go stale if the bag is left open?

Think of ways that you can test your results.

You need to write out your experiment process in a list, but you will need to be sure to include the following details:

- Materials that you will need. Include sizes or brand names if that's important. Always list the amounts (using the metric system of course).
- The step-by-step process you will follow to set up and run the experiment.
- How long you think it will take to conduct the experiment. You have approximately four weeks to complete your experiment so you'll need to stay within this time frame.
- Details on how you will monitor the experiment's progress.

If you need to design a form or chart, please submit that with your design. Sketches are also great if they help explain your idea.

Let's talk about variables and controls. If I'm testing for which battery lasts longer, I need to have several battery brands. These are my variables. BUT what if I test one of each battery but unknown to me the Duracell battery was a dud to start with. Is that fair to Duracell? To *control* this situation, I should use more than one of each type of brand. In fact, ideally I should use at least ten of each type and take an average. This can get costly though – so three of each type would be acceptable. Expose them all to the exact same test. If you put one in a flashlight and one in a toy car, you won't really know which one has the most staying power as each device drains a battery at a different rate.

Or – what if I want to determine if coffee helps plants grow? From the first example, you should now realize that we would need several plants to test this with, just in case we get a plant that has something else wrong with it. In this case, the coffee is our variable. So… how do we know if coffee is a good or a bad thing for plants? We'd need to test it against how plants normally grow – that is, with water. Water would be our control. Again, ideally you would need many plants that you give water to and many plants that get coffee. Keep ALL plants in the same area and give them equal amounts of each liquid. In other words – the only variable should be the type of liquid that they are receiving. Control as many factors as you can so that the results are only about the question you are asking.

If you are testing something that can be subjective – like which tastes best, Coke or Pepsi – this is an opinion test. You will need at least 100 tests to make this an accurate experiment. To understand why, read Sample Size: How Many Survey Participants Do I Need? (sciencebuddies.org)

By the way – an experiment that just asks for a preference between two products is kind of boring. Add some more details such as age or gender. Be creative!

In your experiment design, make it clear how you will keep control of all the factors in your experiment so that you are truly testing only the variable.

Write a paragraph (5-8 sentences) containing your hypothesis. And, on a separate piece of paper write out the details of your experiment. Be sure to label both papers.

Two Pages of Research

You will have received some notes back from me when you wrote your original four paragraphs on your research. You will also have had time to continue researching as you drafted your hypothesis and experiment design. Now is the time to expand your original four paragraphs into at least two full pages of research. Your working outline should help you here.

This section does NOT contain any information on the project you are designing. Remember – it is research about what others have done.

Also note that two full pages means just that. If you start about four inches from the top of your first page because of your paper's headings, then you should go to at least four inches (or more) on a third piece of paper.

Use the following format:

- Double space
- Indent your paragraphs
- Times New Roman, Calibri or Arial font – size 12
- 1 inch margins all around
- **This is a formal research paper. Please avoid using first person pronouns (I, we, my, me) and second person pronouns (you, your). Do not use contractions. Be aware that the informal way you may speak or say something will need to be worded in a more formal manner and/or a more scientific manner.**
- Footnote/cite your sources within the body of your paragraphs – use a one- or two-word citation in parenthesis.

Do a good job here and you'll be finished with this research section of your paper.

When we read your rough draft we should be able to relate your research to the science experiment you plan to do. Please be sure your research is related to your science project. Think of the variables you intend to have in your experiment. These variables are what you should cover in your research.

Even though this is a rough draft, you should take the time to revise and edit your rough draft. I've attached both a 'Revision Checklist' and an 'Editing Checklist' for your use.

Submit two full pages with footnotes on the research you have completed about other scientists and their work in the area of your project. Include your working outline.

Revision Checklist

1. Eliminate unnecessary or needlessly repeated words or ideas.
2. Combine or reorder sentences.
3. Change word choices for clarity and expression.
4. Know the purpose: to present research relating to the experiment you plan to do.
5. Know the audience: the reader(s) of the writing.

Editing Checklist

Sentence-by-Sentence Check: Usage and Mechanics

1. Check for complete sentences: subject, verb, complete sense, capital letter, and end mark.
2. Check for words that are left out and check for words or ideas that are repeated (except for a concluding sentence that summarizes, or paraphrases, the topic sentence).
3. Check all words for capitalization mistakes.
4. Check for all punctuation mistakes, which include 5 areas:
   (commas, periods, apostrophes, quotation marks, underlining.)
5. Check for subject-verb agreement mistakes.
6. Check for problems in usage (pronoun usage, double negatives, a/an choices, etc.).
7. Check for misspelled words.
8. Write out all numbers as words.
9. Do not use contractions; write out the words.

Sentence-by-Sentence Check: Style and Sentence Structure

10. Check for sentence variety. Do not begin all sentences with the same word.
11. Check for too many simple sentences. Use simple, compound, and complex sentences.
12. Check for run-on sentences: two sentences connected with a conjunction and no comma.
13. Check for a comma splice: two sentences connected with a comma and no conjunction.
14. Check for correct punctuation of complex sentences: use a comma after the first sentence only if it is dependent or cannot stand alone.

Paragraph Check

15. Check to see that each paragraph is indented.
16. Check each paragraph for a topic sentence.
17. Check each sentence to make sure it supports the topic of the paragraph.
18. Check the content for interest and creativity.
19. Check the type and format of writing assigned.

Rough Draft

20. Have you written the correct heading on your paper?
21. Double spaced?
22. 1” margins all around?
23. Times New Roman, Calibri or Arial font – size 12?

Checklists have been taken from The Shurley Method: English Made Easy, Level 7 by Brenda Shurley.

Formal Submission of Experiment Design

You will have received notes back from me on the first draft of your experiment design. You will also have had time to put a little more thought into the process and start gathering your materials. For this assignment you are to formally write up the procedure for completing your experiment. It must contain enough detail that someone else could come behind you and complete your experiment based solely on your instructions.

Again, include brand names and sizes if that information is appropriate, always using metric measurements. Give the reader step-by-step instructions on setting up and maintaining the experiment. And, tell us how you will be keeping track of the results. (By the way, if you are copying the instructions from a pre-designed experiment be sure to make changes that will make the experiment line up with exactly what you are doing.)

Include forms, charts or sketches if they are appropriate for your design. Be clear about how you will control all the factors so that you are only testing the variable(s) you want to test.

Experimentation

Go to work! NOW that you have worked through the design process, it's time to start the actual experimentation. You'll be told this in class, but don't get antsy and start early as you may have to totally redo your experiment based on any changes we make during the process. (Yes – this has happened to students in the past.) But, if you have successfully worked through all the previous steps, you are ready to get started with the experiment.

You will be given several weeks for this part – but don't procrastinate. Even if your experiment is designed to be completed all in one day – don't make it the day before the work is due. Something unexpected could happen and you'll need the additional time to make corrections.

Important – even if your experiment does not turn out how you expected it to that does not mean that the project is a failure. What happens if you plant a bunch of seeds and NONE of them grow? Or, what if you expected mold to grow on your stale bread but something unknown ate it instead? If possible, repeat your experiment to see if you continue to get the same (or about the same) results. The more times you repeat the process, the more accurate are your results. And – if it still doesn't work like you expected then analyze *that*. Your conclusion will be an analysis about why your experiment turned out differently than anticipated.

Keep good records of your results. Record the date, measurements, times, whatever is appropriate for your test. If possible, also take pictures as you go. If you are testing people's reactions (taste tests, etc.), it is not necessary to record their names. Only record factors that are pertinent to your test such as gender, age range, hair color, or dominant hand – you know, in case you're wanting to test whether left-handed boys can throw a ball farther than right-handed boys.

Submit the formal write-up of your experimentation process. This can still be tweaked as you work through your experiment but be as detailed and as accurate as possible. Begin working at home on your experiment, tracking results as you go.

Introductory Paragraph

I know this seems a little backwards to just now be writing the introductory paragraph – but you've now spent lots of time with your experiment and you have a better idea of how to introduce it to your reader.

This paragraph is your *hook*. It's what will entice the reader to delve into your paper. Don't just start off with a vague statement like "Did you ever wonder about…" or "This paper is about…"

E-how.com gives this advice:

- Write down the most interesting things about your essay. Is there something surprising in what you have written? Does a specific image come to mind?
- Explain the most interesting aspect of your essay to someone else. If you're stuck, try completing these sentences:
    - When I was thinking about this, I could not believe that _____.
    - It was amazing to me that _____.
    - Imagine what it is like to _____.
    - The image I cannot get out of my mind is _____.

  However, do not include these sentences in your paragraph – they contain first person pronouns. Reword them to the more formal third person (It is hard to believe that . . . It is amazing . . .).
- Determine the aspect of your essay that would be the most interesting and compelling to someone who has no idea what you are going to say.
- Maybe you have a note card with interesting information that you didn't use in the body of your paper that would fit well here.
- Write this 'most interesting' fact or image in a sentence or two. Refine it. Read it out loud. It should match the tone of the rest of your essay.

Give at least five to eight good sentences that will excite your reader about your paper. Do not give details here about your experiment or research – only hints.

Remember, this is a formal research paper. Please avoid using first person pronouns (I, we, my, me) and second person pronouns (you, your). Do not use contractions. Be aware that the informal way you may speak or say something will need to be worded in a more formal manner and/or a more scientific manner.

Submit a well written paragraph (5-8 sentences) introducing your project. Hook your reader.

Experiment Results

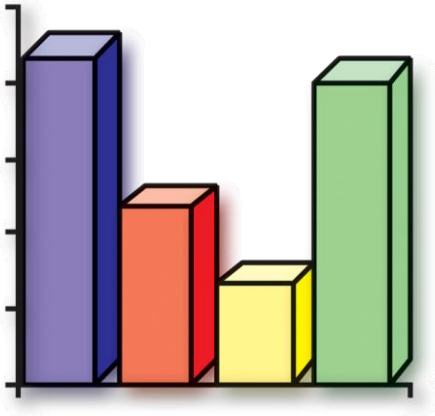
Hopefully by now you have completed the majority of your experimentation and are recording the results. You will submit the results in two ways: (1) raw data and (2) interpretation of your data.

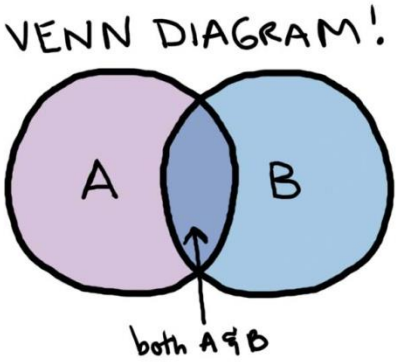
For now, we'll focus on the raw data or simply the basic results of your experiment. For example, how many people chose Coke and how many people chose Pepsi? Or, how long did the Duracell battery last and how long did the Eveready battery last? Submit the results for every test that you completed. If possible, submit all the information. For example, if you tested 5 Duracell batteries and 5 Eveready batteries, tell us how long each individual battery lasted. However, if you asked 100 people whether they preferred Coke or Pepsi, rather than list 100 responses, give the total number who chose Coke and the total number who chose Pepsi (along with whatever other details you added to make it more interesting).

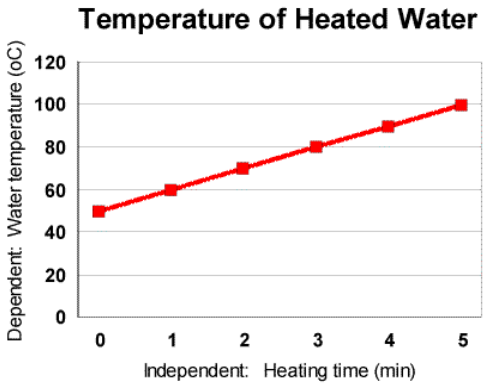
In addition to raw data, give us something to visually understand the results. This is best done with some type of chart. For example, a bar chart, pie chart, line graph or even a Venn diagram will aid the reader's understanding of your experiment results. Just be sure to label it well so that the reader knows exactly what each section of the chart stands for. It might be a good idea to try and put your data into several types of charts to determine which one really does the best job with your data.

Page 345 of your textbook has a good example of building Bar Charts.

Submit your data to date and if you're ready, go ahead and design a chart to help explain your data. By the way – this chart will also be going on your backboard.







Final Experiment Results and Interpretation

By now you should have completely finished all of your experimentation and obtained multiple sets of data to work with. All of this information needs to fit neatly into your final paper. Follow the guidelines previously given for reporting your data and putting it into chart format. **You should have a few sentences summarizing your results (for some of you this may be a few paragraphs), your data table, and your chart/graph of results.**

You are now ready for the second part of this section – interpreting your data. This section of your paper will be entitled "**Conclusions and Real-Life Application**"

Say that out of your ten battery tests, all five Eveready batteries lasted longer than all five Duracell. Those are pretty clear results and you can say that Eveready batteries are longer lasting than Duracell. But, what if in three tests Duracell did better and in two tests Eveready won out? And, what if Eveready lasted twice as long as Duracell in those two tests while Duracell only lasted ten minutes longer in the tests that they won – now how do you interpret those results? If you can, determine some other factor that had an effect – reevaluate how you ran your experiment. If there was no other factor, then there are no clear differences in battery brands.

Also, in interpreting scientific results, you should not use phrases like "better than/worse than" or "more/less". You need to be specific. For example, rather than saying "Watering plants with coffee makes plants grow more than watering plants with plain water," you would say: "Watering plants with coffee results in an average growth of three more inches per week than watering plants with plain water."

As part of this section, tell us whether your hypothesis was correct (be sure to restate your hypothesis so the reader does not have to search for it). Did you get the results you originally expected? Then explain why or why not, connecting this back to your research.

Example: These results support the hypothesis which states, "If _____, then _____." plus five to eight explanatory sentences, or These results do not support the hypothesis which states, "If _____ _____, then _____." plus five to eight explanatory sentences.

And, finally, **tell us how we can use your results in real life. This should take at least two paragraphs.** Longer would be even better. Remember, research is paid for by business companies. If they cannot use your research to make money, they will stop funding you. Really think through how a business could use your results for their gain. (Realize, it may be that your results prove to a business NOT to do something.)

Remember, this is a formal research paper. Please avoid using first person pronouns (I, we, my, me) and second person pronouns (you, your). Do not use contractions. Be aware that the informal way you may speak or say something will need to be worded in a more formal manner and/or a more scientific manner.

Submit your final experiment results with paragraph summary, data table, charts and graphs. Also write your conclusion and whether your hypothesis was correct. Finally add at least two paragraphs (5-8 sentences each paragraph) telling how your results can be used in real life.

Science Project Paper

If you're reading this, you're almost done!

It's time to begin assembling all the work you have completed into your final paper. Gather up everything you've done so far and follow the guidelines below to complete your project.

There will be sections that you have not done yet, but they are relatively simple – just do them as you go.

Layout Requirements:

- Double space, indent your paragraphs ½"
- Label each section with a bold headline
- Times New Roman, Arial or Calibri font – size 12
- 1 inch margins all around
- Number your pages in upper right corner (not necessary on the title page, but it counts as pg 1)
- Footnote/cite your sources in the research section – use a one- or two-word citation in parenthesis.

Your paper should contain the following sections:

- **Title page** – Come up with a title for your work – this will appear on your backboard as well. The title should be in bold and centered towards the top of the page – a larger font is okay here. On the bottom half of the page center your full name, the date due, your class – ex. PEP Life Science – and your teacher's name.

- **Table of Contents page** – telling which page each of the following sections begins.

- The body of your paper should flow – do not change pages each time you start a new section. Do not have an additional blank line space between each section. The headings will be used as separators. Your body should contain these sections:
    - **Introduction** (one paragraph) – this is your hook and the basic introduction explaining your project. It will include why you chose the project and what you will be testing.
    - **Hypothesis –** stands alone, then one paragraph explaining what you expect to observe and why
    - **Acknowledgements** (one paragraph) – acknowledge any people who helped you in your project. You may use first person pronouns (I, we, my, me) in this paragraph.
    - **Research** (two or more pages) – this is all that work you did in the beginning with all of my red line changes. Copy it here – being double sure that you have cited all sources.
    - **Materials** (list) – be very specific. Include brand names, sizes, weights or volumes, quantity, etc. (metric). If you built anything, include the procedure for construction. You may insert pictures or diagrams here (not of your experiment – only of devices you may have used). Questionnaires and blank data tables should be listed here and copies placed in an Appendix.
    - **Experimental Procedure** – a simple and complete list of the steps you used. Someone should be able to take your materials list and your procedures section and completely duplicate what you did. Don't leave anything out.

- **Data and Results** (three or four pages) – start by showing your data, explain what it all means and end with any graphs or charts that make it easier to interpret the results. This section will be a combination of writing and charts. Again, pictures and diagrams will go well here. *Caution: do not make the graphics huge – just large enough to be readable. Make sure they are well labeled. We should understand what everything in your charts or graphs mean.*
- **Conclusions** (one paragraph) – what can you interpret from your results? Did you have a correct hypothesis? Why or why not?
- **Applications** (two paragraphs, maybe more) – How can someone use these results in real life? (yes, two paragraphs of real life application)
- **Appendix A – Blank Data Table** – if you used a data table in your experimental procedure then you need to include a blank one here as an Appendix.
- **Works Cited** (this is a separate page) – see the *Bedford Handbook* or *Writers, Inc.* for instructions on completing this accurately. Or, you can find MLA guidelines online at The OWL at Perdue. MLA Formatting and Style Guide // Purdue Writing Lab

▪ **PROOFREAD!! Have someone else proofread!! PROOFREAD!!** Be sure that your paper flows well and that someone who is not familiar with science or with your project can understand what you have written.

Congratulations – you have done a lot of work and here is where it shines!

It is important that you submit your first draft on the day it is due. I will be doing one last read-through and adding any last-minute notes. I want to be able to return the paper to you as soon as possible so that you can complete your final copy. After that, you will only have one week to turn around the final copy. Please do not e-mail it to me. I need the hard copy.

Use the 'Research Paper Checklist' to ensure your paper is complete.

Research Paper Checklist

General Information

- Does your paper have an introduction, body and conclusion?
- Does each sentence support the main idea of each paragraph?
- Do your main topics and supporting sentences follow the order of your outline?
- Have you capitalized and punctuated your sentences correctly?
  Check carefully for misspelled words. Use a dictionary!
- Correct any obvious grammatical errors and rewrite poorly worded sentences.
- Read your paper orally to see how it sounds.
- Check your paper for sentence fragments and run-on sentences.
- Have someone read the paper and give you his thoughts. If the paper is not clear to your reader it will need to be reworked.
- When complete, have someone proofread the research paper before you hand it in.
- Check each part of the paper to make certain you used correct form.
- If typing, use 1" margins (top, bottom, left and right) and double space. Use the page numbering feature (upper right corner, title page is first page).

Theme folder

- **Use a clear plastic report cover to hold your paper.**

Title Page

- Write the title of the research paper near the top of the page, in bold and centered.
- Write near the bottom of the page and centered: your full name, the date due, your class name and your teacher's name.
- You should have a clean, blank page following the title page.

Table of Contents Page

- Centered on the top line of the paper write *Table of Contents*.
- On the fourth line from the top write the title of your research paper and at the right-hand margin write page ____. (You will have to supply the proper page number).
- On the sixth line write *Introduction* and at the right-hand side write page _. (You will have to supply the proper page number). Some sections will have the same page number.
- On the eighth line write *Hypothesis* and at the right-hand side write page _____. (You will have to supply the proper page number). Some sections will have the same page number.
- On the tenth line write *Acknowledgements* and at the right-hand side write page _____. (You will have to supply the proper page number). Some sections will have the same page number.
- On the twelfth line write *Research* and at the right-hand side write page _____. (You will have to supply the proper page number).
- On the fourteenth line write *Materials* and at the right-hand side write page _____. (You will have to supply the proper page number). Some sections will have the same page number.
- On the sixteenth line write *Experimental Procedure* and at the right-hand side write page _____. (You will have to supply the proper page number). Some sections will have the same page number.
- On the eighteenth line write *Data and Results* and at the right-hand side write page _____. (You will have to supply the proper page number). Some sections will have the same page number.
- On the twentieth line write *Conclusions* and at the right-hand side write page ____. (You will have to supply the proper page number). Some sections will have the same page number.
- On the twenty-second line write *Applications* and at the right-hand side write page _____. (You will have to supply the proper page number). Some sections will have the same page number.

- On the twenty-fourth line write *Appendix A – Blank Data Table* and at the right-hand side write page _____. (You will have to supply the proper page number). The Appendix will be its own separate page. This is only included if you have something to add in an Appendix.
- On the twenty-sixth line write *Works Cited*, and at the right-hand side write *page* . (You will have to supply the proper page number). The Works Cited will be its own separate page.

Main Body of the Research Paper

- The first page of the paper after the Table of Contents should have the title centered on the top line.
- Each page should include the student's last name and be numbered in the upper right corner (in the header).
- The first paragraph of the paper should be an introduction to the paper. It should tell what the paper is about.
- Skip a line after the title and begin the first paragraph.
- Indent all paragraphs one inch from the left margin.
- Mount pictures and diagrams on sheets of paper and include them in the research paper where appropriate.
- The last paragraph of the body should summarize the research paper.

Appendix Page

- Center the words *Appendix – Blank Data Table* on the top line.
- Number this page in the upper right corner (in the header, including the student's last name).

Works Cited Page

- Center the words *Works Cited* on the top line.
- Number this page in the upper right corner (in the header, including the student's last name).
- List the entries from the working bibliography, alphabetized by author's last name.
- Skip a line after *Works Cited* and write the first entry.
- Skip one line between entries.
- *Do not* include page numbers of use in your paper in your entries.
- If your working bibliography was done properly, you just copy the information from those cards.
- Write as much on a line as possible. If you need a second line, indent it one inch. Indent other lines if needed. *You'll find 'hanging indentation' as one of your options for paragraph formatting in your Word program.*
- A blank page should follow the *Works Cited*.

All information and suggestions on a science fair project are taken from an A Beka Book entitled A Science Project by DeWitt Steele. Checklists have been copied with permission. Details on preparing a research paper are taken from The Shurley Method: English Made Easy, Level 7 by Brenda Shurley.

Science Project Backboard Design

The backboard is used to give a visual overview of your project. Most people won't be reading your paper – they will be looking at your backboard, so it will need to tell the whole story.

- Review your experiment and decide what information you wish to present. You will not be able to present everything, so select carefully.
- As part of your backboard, prepare a clear statement of the experiment's hypothesis.
- Choose a clear, concise title.
- Present your work on a tri-fold display board.
- Plan your backboard so that it clearly tells its story.
- Keep titles short.
- Show the equipment you used – it is not necessary to show it all. (Maybe laid out on the table in front of backboard if not too extensive or maybe a picture.)
- Be sure you list the results of experiments.
- A detailed record of your work, a journal/logbook should be displayed. (Maybe laid out on the table in front of backboard.)
- The science project paper you wrote on the topic should be displayed. (Maybe laid out on the table in front of backboard.)
- Photos/drawings, diagrams, graphs/charts, tables and other helpful visuals will help tell the story.
- Include conclusions you draw and real-life applications.
- You should read the backboard from left to right

- Use a three-paneled backboard and divide it as follows:

	TITLE OF YOUR PROJECT	
Problem Hypothesis Procedures	Photos/Drawings Graphs/Charts Tables *Use what works best for your project on this panel. Just be sure that everything is well labeled.*	Results Conclusions Real-Life Applications

Note: photos should be of the project – not of you.

You will repeat information from your paper on the backboard, but please don't just cut out and paste your research paper to the board. Get creative!! Not every detail from your paper needs to be included here – just enough to give the reader good information on your project. Make people *want* to read it!

It also needs to be read from farther away – so enlarge fonts if you're printing from your computer. Place your name small and neatly in the bottom right corner to help others identify who did the work.

Add some color! Do not just put a white piece of paper on a white backboard. Add some color borders to your white paper (construction paper is good) so they stand out on your white backboard.

Resist the temptation to ask your parents for help here. You can, of course, ask questions and get help with logistics and supplies – but this should reflect <u>your</u> abilities.

Science Project Backboard Checklist

Lettering
- Title in large letters
- Subtitles in smaller letters
- All lettering neat and professional looking

Arrangement of materials
- New, clean science project paper included (not your graded paper)
- Journal/logbook included
- Appearance uncluttered
- Experiments OR experimental materials ready to be set up as part of exhibit

Contents
- Title short but accurate
- Hypothesis stated clearly
- Experiments listed (procedure)
- Conclusions and real-life applications clearly stated
- Photos/drawings, diagrams, graphs/charts, tables or other visual means used to aid viewers

Questions to consider about the exhibit

Does the exhibit illustrate:
1. completeness of observation?
2. controlled experimentation?
3. understanding and statement of theories?
4. meaningful analysis of results?
5. cause and effect reasoning?

Does the exhibit show real study and effort?

Does the exhibit show that a planned system has been followed?

All information and suggestions on a science fair project are taken from an A Beka Book entitled A Science Project by DeWitt Steele. Checklists have been copied with permission. Details on preparing a research paper are taken from The Shurley Method: English Made Easy, Level 7 by Brenda Shurley.

Oral Presentation

During class you will present an oral report about your scientific investigation. Include the following in the oral report:

- Tell the goal of your investigation.
- Give the results.
- **Include pertinent information from your science research paper.**
- Explain what your experiments were and relate what was accomplished by doing them.
- Include any interesting things that occurred during your investigation.
- Tell how you overcame problems which arose.
- Be ready to answer questions about your work from your classmates and teacher.
- Prepare note cards for use as you give your report. Do not read your report. Speak loudly and clearly. Show confidence.
- Practice your presentation so that you will not end too soon or speak too long. Rehearsing in front of a mirror may be helpful.
- Plan an interesting opening statement. **Do NOT** begin by saying, "My report is about …."

Still need more help to organize your thoughts? How about fill in the blank. At a **minimum** you should answer the following in your oral presentation.

- The title of my project is _____.
- I selected this topic because _____.
- My hypothesis was _____.
- The research that supports this hypothesis is _____.
- The procedure I followed began _____.
- The results I collected were _____.
- I analyzed my data by _____.
- My conclusions from this experiment are _____.
- A real-life application of these results would be _____.
- End your presentation by inviting questions. If you don't know the answer, just say so.

On the date assigned for your oral presentation, you will bring your completed Science Project Backboard to class where it will be displayed.
DRESS: Dress is casual for your presentation. Please, no t-shirts, no shorts, no holes in jeans, no flip-flops. You are presenting the formal findings of your research and experiment to your peers.
TIME: The oral presentation has a minimum and maximum time requirement. These time limitations will be closely adhered to when determining your grade. Should your presentation be not more than two minutes too lengthy, no penalty will be given. Presentations which are too short will be penalized. The time allowed for questioning by your audience is not counted as part of your time requirement.
7th grade: 3-5 minutes

SCIENCE PROJECT – FINAL GRADING SHEET

Final Paper:

	Points Possible	Points Earned
Research: Thorough Clearly presented	60	
Cited at least four sources Works Cited page accurate	10	
Experiment: Planned well Repeated sufficiently Adjustments made if needed Scientific process followed	45	
Results: Data presented well (readable and understandable) Good interpretation of results	45	
Real Life Application	20	
Paper formatted correctly	10	
Overall content and organization	10	
TOTAL	**200**	

Presentation:

	Points Possible	Points Earned
Oral Presentation Good eye contact with your audience Organized, sequential presentation Thorough	35	
Backboard Attractive, neat and balanced Labeled well Easily understood by the average person	45	
Knowledge Able to answer questions well	10	
TOTAL	**90**	

Works Cited

Berry, Hillary. Science Fair Project Notebook c. 2004 *Many ideas and concepts found in this packet were taken from the Science Project Packet designed by Hillary Berry of the Westgate Co-op, Jacksonville, FL.*

Mastronicola, Joanne. *Science Project Packet* c.2016 *Many ideas and concepts found in this packet were taken from the Science Project Packet designed by Joanne Mastronicola of PEP, Jacksonville, FL.*

Novak, Melanie. "How to Write a Hook for an Essay." *EHow*. Demand Media, 26 June 2009. Web. 16 Aug. 2012. http://www.ehow.com/how_5127257_write-hook-essay.html.

Shurley, Brenda, Ruth Wetsell and Teddie Raines. The Shurley Method: English Made Easy, Level 7. Cabot: Shurley Instruction Materials, Inc., 1995.

Steele, DeWitt. A Science Project. Pensacola: A Beka Book, 1990.

"Welcome to the Purdue OWL." Purdue OWL. N.p., n.d. Web. 16 Aug. 2012. http://owl.english.purdue.edu/owl/.