Science Fair
Project
Workbook

Name ______________________________

Period ____

Teacher _____________________________

(use only pencil when writing in this booklet)
Why A Science Project?

Science projects give students the opportunity to study a subject of individual interest. Interest is the key word. Science experiments can be developed from topics as varies as water skiing, swimming, basketball, music, art, rocketry, robotics, and computers. Science projects are intended to help students realize that science is found in every niche of the universe. Science projects allow students to:

- Practice the scientific method to use and develop understanding of controls and variables
- Take an open and creative approach to problem solving
- Sharpen their writing skills. Students are encouraged to avoid the use of personal pronouns (I, me, my) and instead use appropriate citation of sources (the researcher).
- Gain skills in library use
- Organize time and develop time management skills
- Develop public speaking by presenting projects to classmates
- Compete in a science fair where students and their projects are recognized for academic achievement. The judging process also provides an invaluable experience in developing poise and quick-answer thinking

Using the Scientific Method

The standard expectations for an individual science project are listed below. Students are expected to meet these minimum standards.

1. Research a selected topic.
2. Ask a question that can only be answered through scientific testing. This is called the problem question.
3. Write a hypothesis that will help answer the question.
4. Design and experiment to answer the scientific problem question.
5. Maintain a scientist’s data notebook.
6. Complete a formal written report that includes:
   - Problem question
   - Statement of purpose
   - Background research
   - Hypothesis
   - Procedure
   - Materials
   - Results
   - Conclusion
   - Bibliography
7. A backboard display or required information including an abstract.

8. Complete all necessary forms prior to each deadline.

Let’s Get Started!!!!!!

STEP 1 Choose a topic (a question)

A good topic has a problem that can only be answered by experimentation. If a topic is too broad and general, too many factors (controlled variables) will exist. Students will find it difficult to produce reliable results. Each student starts by asking a question that can only be answered by experimentation.

Write your topic question below. It must be in the form of a question.

______________________________________________________________________________
______________________________________________________________________________
________________________________________

STEP 2 Choose a title

A project needs a title. It is okay, even encouraged, that you use your topic question as your title. You can have a subtitle (a catchy phrase) if you want to.

Example:

Problem question (title): Which Soap Powder Removes Catsup Stains the Best?

Additional “Catchy Phrase”: Does your Soap have Muscles?

NON-examples of titles:

“Soap Power”, “Cleaning Power of Soap Powder”

STEP 3 Statement of Purpose

The purpose of the project is to be worded in a concise manner, stating exactly what is to be concluded/answered through the project. The purpose statement is usually just one to three sentences explaining what is to be accomplished with the project.
Example:

*The purpose of this project is to* find out if brine shrimp can adapt to fresh water.

Write your statement of purpose here:

The purpose of this project is ________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

STEP 4 **Library Research**

You must research your topic so that you are up to date with the latest developments on the chosen topic. This will help you to understand the importance of what is being done. To gain the knowledge you need on your topic, much research must be done. You should use the library, the computer (avoiding Wikipedia), books, scientific articles in magazines, and personal interviews of knowledgeable people in order to have solid research.

When you find useful information you should

- take written notes on it for your written report
- record where you found the information
- and save it for your bibliography.

It is very important that information be written in your own words. You must write using your own words. Your library research will be between 2 and 10 pages. Some topics may be difficult to research because there may be a few other scientists **THAT HAVE EXPLORED** the topic.

Where could you find information on your topic?

List several places you could go to find information on your topic.

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
STEP 5  **Formulate the Hypothesis**

The hypothesis is a statement of the expected outcomes of the experimentation. The hypothesis should be based on research of the topic and any prior knowledge or experience.

All Hypotheses should include the following parts:

1. focus of the experiment
2. explanation of what is being measured
3. conditions
4. expectations

The Hypothesis should be written in the
If…………., then……….., because………………., format.

Example:
If three different disposable cameras are compared to see which take the best pictures, then the Kodak camera will take the best pictures, because it has the best quality film.

If ____________________________________________, then________________________________, because________________________________________.

STEP 6  **Design and conduct the experiment.**

Design an experiment to test the hypothesis.

Variables

**Identify variables in the experiment:**

1. **Independent Variable:** the variable to be changed to determine what effect it will have on another variable.

2. **Dependent Variable:** the variable that changes in response to the independent variable.

3. **Variables held constant:** all variables that are kept constant to ensure validity of the results.
4. **Conduct the test A.K.A. Do the experiment:** be sure to conduct multiple trails or to use a large test sample. Record!!!! Systematically record all data in a log or journal.

- **Independent variable**
- **Dependent Variable**
- **Controls/constants**

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**Plan ahead how you will organize the data you gather from the experiment.**

**Will it be data that:**

a. fits onto a chart that you create?

<table>
<thead>
<tr>
<th>College</th>
<th>New students</th>
<th>Graduating students</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Undergraduate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cedar University</td>
<td>110</td>
<td>103</td>
<td>+7</td>
</tr>
<tr>
<td>Elm College</td>
<td>223</td>
<td>214</td>
<td>+9</td>
</tr>
<tr>
<td>Maple Academy</td>
<td>197</td>
<td>120</td>
<td>+77</td>
</tr>
<tr>
<td>Pine College</td>
<td>134</td>
<td>121</td>
<td>+13</td>
</tr>
<tr>
<td>Oak Institute</td>
<td>202</td>
<td>210</td>
<td>-8</td>
</tr>
<tr>
<td><strong>Graduate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cedar University</td>
<td>24</td>
<td>20</td>
<td>+4</td>
</tr>
<tr>
<td>Elm College</td>
<td>43</td>
<td>53</td>
<td>-10</td>
</tr>
<tr>
<td>Maple Academy</td>
<td>3</td>
<td>11</td>
<td>-8</td>
</tr>
<tr>
<td>Pine College</td>
<td>9</td>
<td>4</td>
<td>+5</td>
</tr>
<tr>
<td>Oak Institute</td>
<td>53</td>
<td>52</td>
<td>+1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>998</td>
<td>908</td>
<td>90</td>
</tr>
</tbody>
</table>

*Source: Fictitious data, for illustration purposes only*
Students will need to incorporate or complete the following steps when conducting tests (doing experiments):

1. Use instruments that measure: scales, thermometers, stopwatches, meter sticks, gauges, or any instrument appropriate for the experiment.

2. Decide which controls and variables should be used.

3. Determine the length of the experiment.

4. Use trial and error.
A true scientist believes that all experimental errors are important.

5. Incorporate replication (you repeating someone else’s work) and repetition (you repeating your own work). The results must be repeatable if they are to be trusted.

6. Be a good observer. If a researcher fails to pay attention to the entire experiment, something important may be missed.

7. Measure exactly. Too much or too little could change all the results and make them inaccurate. **All measurement should be made in metric units.**
6A List of Materials and Equipment

Make a list of all the materials and equipment needed for the experiment. It is necessary to have all materials gathered and all equipment assembled before starting the experiment. The materials list should list exactly:
- the item
- the kind
- how many
- how much is needed.
- Remember quantities are important.

6B PROCEDURES

- It is now time to write step-by-step directions on how to carry out the experiment.
- Each step should be numbered so that another person could follow them exactly.
- Directions are like a recipe: easy to follow and simply written.
- Anyone who read them should be able to replicate the investigation (experiment) and get the same results.

Example of step-by-step procedures:

Can Nails be protected from rust?

1. Collect 3 iron nails of the same exact kind.
2. Coat the 1st nail with petroleum jelly.
3. Paint the 2nd nail with clear nail polish.
4. Leave 3rd nail unprotected.
5. Pour 50 mL of tap water into each of three 100 mL beakers.
6. Add 10 mL of white vinegar to each.
7. Place one nail in each of the three beakers.
8. Check the nails every 6 hours for a total of 48 hours.
9. Record any changes you see at the six hour interval and a data table.
10. After the 48 hours, remove the nails and complete the final comparison.

Before starting your project all forms must have the appropriate signatures and dates.
6C Making observations and recording data

A small notebook should be kept for use as a daily log. Students are to keep notes about everything related to this science project. The following must be included in the daily log:

- List of all materials used
- Notes on all the preparation made before starting the experiment
- Information about the resources used
- Detailed day-by-day notes related to the project development and progress
- Any drawings that may help explain work
- Data that is gathered from experiment (notes, tables, charts, graphs).

Students are to record daily observations and the date and times they are made. They should write down problems as they occur. Two types of observations can be recorded:

- Empirical observations (those that are done using the senses)
- Observations using measurements and instruments

Written records of observations, measurements, etc., saves data from being forgotten or lost.

Example:

Gerbil’s Eating Record

<table>
<thead>
<tr>
<th>Date</th>
<th>time</th>
<th>food</th>
<th>observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/17</td>
<td>2:00 pm</td>
<td>5g mixed grain</td>
<td>ate by 7 pm</td>
</tr>
<tr>
<td>10/18</td>
<td>3:00 pm</td>
<td>2 g mixed grain</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 cm med carrot</td>
<td>took carrot to nest</td>
</tr>
<tr>
<td>10/19</td>
<td>9:00 am</td>
<td>4g mixed grain</td>
<td>hand fed 2 g &amp;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ate in 30 min.</td>
</tr>
<tr>
<td>10/20</td>
<td></td>
<td></td>
<td>Went to Bill’s Pet Center to discuss proper care of gerbils</td>
</tr>
</tbody>
</table>

STEP 7  Determine the Results/Analysis of Data

- Compile or average your data to determine if the data supports or fails to support the hypothesis.
- This should be written in discussion form.
- Notation, graphs, charts, pictures, and power points may be used to illustrate and supplement data.
- Usually, information is organized first into a chart or table.
- Then a graph is made so that data can be seen in a different way.
• Making a graph is especially helpful when attempting to show how two or more things compare.

**STEP 8** **Draw Conclusions**

State outcomes of the experimentation and explain what conclusions have been made/what has been learned. Describe how this knowledge might be applied in the future. If further investigations seem appropriate, describe them. Was the hypothesis accepted or rejected? Before writing a conclusion, all data must be carefully examined.

The Conclusion should include the following:

1. The statement of purpose.
2. The Hypothesis and a statement claiming to have proven or disproved your hypothesis.
3. A description of any problem or unusual events that happened during the experiment.
4. What the experimenter would do differently the next time.
5. A revised hypothesis is the data failed to prove the original hypothesis.

**STEP 9** **Write an Abstract**

An abstract is an overall summary of the experiment. It is a shortened version of the entire research paper. The following format should be used:

**Block 1**

TITLE (all Capitals)
Last name, First name, Middle initial

1. Type single spaced.
2. Use the preset margins of left and right at 1.5” and top and bottom at 1.5 “. Maximum size for type or font is 12 pts.
3. The abstract is a summary of the project. The abstract should be about 250 words. It should include:
   - The purpose
   - The hypothesis
   - A summary of the research and experimental design
   - A brief description of the results
   - The conclusion
4. The abstract should be displayed with the project board.
5. The abstract is to be written in third person. This means no use of the words “I”, “my”, “you”, etc. Instead, use phrases such as “he discovered” rather than “I discovered”.

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Bibliography/reference List

Block 2

1. Reference list 7.25 “from top of page.
2. List major sources of information in this block, including interviews. There should be four or five entries on this page. A complete bibliography should be placed in each student’s research paper.

STEP 10 Write the Bibliography/References

A bibliography is a list of books, articles, encyclopedias, and other sources used to research topic and write a paper.

In a bibliography, certain facts are recorded about the materials. The list is always to be arranged in alphabetical order. Use the MLA format to make each entry.

1. Books
   Author. *Title of Book*. City of Publication: Publisher, Year. Type of Material.

2. Article from a publication - When citing less familiar or specialized reference books, give full publication information, omitting page numbers if articles are arranged alphabetically.
   Author of Article (if given). "Article Title." *Title of Reference Book*. Editor. Vol. number (if any). City of Publication: Publisher, Year. Page(s). Type of Material.

3. Magazine Articles
   Author. "Title of Article." *Title of Magazine* Date: Page(s). Type of Material

4. Scholarly Journal Articles
   Author. "Title of Article." *Title of Journal* Volume number. Issue number (Year): Pages. Type of Material

5. Newspaper Articles.
   Author. "Title of Article." *Title of Newspaper* Date, edition: Page(s). Type of Material.

6. Web Sites When citing web sites, include the author, title, and publication information as for print sources (see above), and add the date of access, because web pages are often updated or moved. All components in the format below may not be identifiable for a web site; include as much as is available.

7. Electronic Books Refer to the format for Books in print, above.
   Author. *Title of Book*. City of Publication: Publisher, Year. *Online Database Name*. Web. Date of Access.
STEP 11 Acknowledgements

In this section, the experimenter, researcher gets to say “thank you” to those who have helped with the project. Those who provided guidance, materials, and the use of facilities or equipment can be included in this section of the paper.

Example: This researcher would like to thank the following people who have helped me with this project:
1. My parents, Mr. and Mrs. Jones, for helping me purchase the materials and driving me to the library.
2. Dr. Adam Smith for providing me with reference materials.

Always try to state who helped and the kind of help or assistance that was given.

STEP 12 Putting it all together – Where to put all this hard work that I have completed!!!

I. The Research paper

Part 1 The research paper will need to have a Title page. Use the entire page.

How Is Cooking Time Affected When Using A Lid On A Pot?

By
Jeremiah Stevens
Period 1
Part 2 The Table of Contents

- Page numbers are to be included
- Maximum font size is 12 pts.
- Use the entire page

Table of Contents

Title page

Table of Contents

Introduction

Statement of Purpose ........................................... 1
Hypothesis .............................................................. 2
Abstract ............................................................... 3
Library Research ...................................................... 4-5

Experiment

Variables .............................................................. 6
List of Materials & Equipment ................................. 7
Procedures ............................................................ 8
Observations and Data ........................................... 9
Analysis of Data ..................................................... 10
(Include charts, graphs, and/or tables)

Conclusion .......................................................... 11
Bibliography/Reference ........................................... 12
Acknowledgements ............................................... 13
Appendix (documents for animal experiments, brochures, etc.)
II. The Display board

Your display board should have all of the following items:

- Problem question
- Statement of purpose
- Hypothesis
- Abstract (2 copies)
- Variables
- Equipment
- Procedures
- Observations and data
- Analysis of data
- Conclusion

The Project board

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Hypothesis</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title of Project (topic question)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchy, fun subtitle if you want one</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Written analysis of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

| Free Space for photos or extra data as needed. |