RESEARCH

Tailoring

The primary goal of the science fair project is to learn the scientific method. The science fair project affords the students an opportunity to practice the scientific virtue of inquiry as they develop and answer a research question and the virtue of diligence as they research, experiment, and record their findings.

When families have time for more:

- Conduct a more extensive experiment.
- Consider increasing the number of repetitions of the experiment to increase the validity of the results.
- Encourage the student to expand the research paper.

When families have a busy week:

- Select a simple experiment that can be accommodated in the time available. Use the "Topic Selection Wizard Tool" on Sciencebuddies.org.
- Reduce the number of repetitions of the experiment.

SCIENCE FAIR

AT HOME

Steps of Research Plan: First semester, Week 12

1. Research Problem
2. Research Question
3. Background Research
4. Hypothesis
5. Procedure
6. Materials List
7. Risk and Safety
8. Data Analysis
9. Bibliography
10. Analysis of Data or Results
11. Conclusions

Procedure: First semester, Week 13

Be as detailed as possible so someone else can duplicate your experiment exactly. If there are various stages, separate the sections by subtitles. Detail all procedures and experimental design including methods for data collection.

Use the Science Fair Project schedule on p.132 to organize assignments from the Research Plan. Record research plan elements in the Science Fair lab journal.

Allocate time to plan and conduct the experiment.

Allocate time to analyze the results.

Practice presenting at home using the project board as seen on p.128

IN COMMUNITY

Community presentations: Second semester, Week 4

Depending on the programs in your community, you could have the students practice presenting in front of Foundations, Essentials, or Challenge Programs on campus before they present for the judges at the actual Science Fair held outside of community day.

Introduce the weekly step from the research plan by asking the students what they know using five common topic questions.

Model the upcoming concept and discuss the process with the students.

Encourage students to share their progress.

Provide opportunity for self, peer, and director feedback on each student's progress on the Science Fair project.

Scientific Method

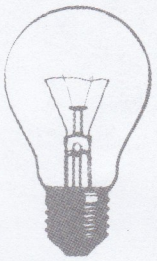
WONDER
"I wonder what would happen if..."

Ask a question about an observation: how, what, when, who, which, why, or where?

ASK A QUESTION

RESEARCH
Ask lots of questions and research the topic to find out what is already known. Use the common topics of definition and authority.

DO BACKGROUND RESEARCH



CONSTRUCT A HYPOTHESIS

HYPOTHESIZE
A hypothesis is an educated guess about how things work: "If____[I do this] ____, then ____ [this] ____ will happen."

TEST WITH AN EXPERIMENT

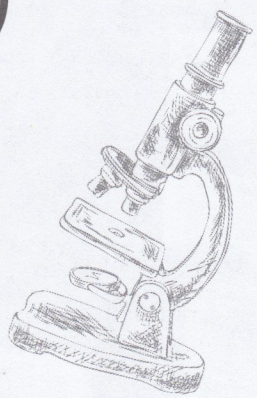
EXPERIMENT
Conduct a fair test by making sure that you change only one factor at a time while keeping all other conditions the same.

TROUBLE-SHOOT PROCEDURE

PROCEDURE WORKING?

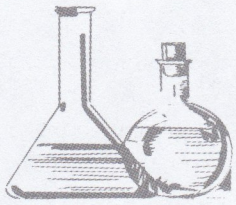
YES

NO



ANALYZE
Analyze the data to conclude whether the hypothesis was valid. What did you learn from the experiment? What is the next step you can take with what you have learned?

ANALYZE AND DRAW CONCLUSIONS



RESULTS SUPPORT, DO NOT SUPPORT, OR PARTIALLY SUPPORT HYPOTHESIS

COMMUNICATE RESULTS

SHARE RESULTS
Document the process in scientific papers and on display boards. Scientists must be prepared to describe and discuss their findings regardless of whether their hypothesis was proven to be true.

Classical Conversations®

RESEARCH

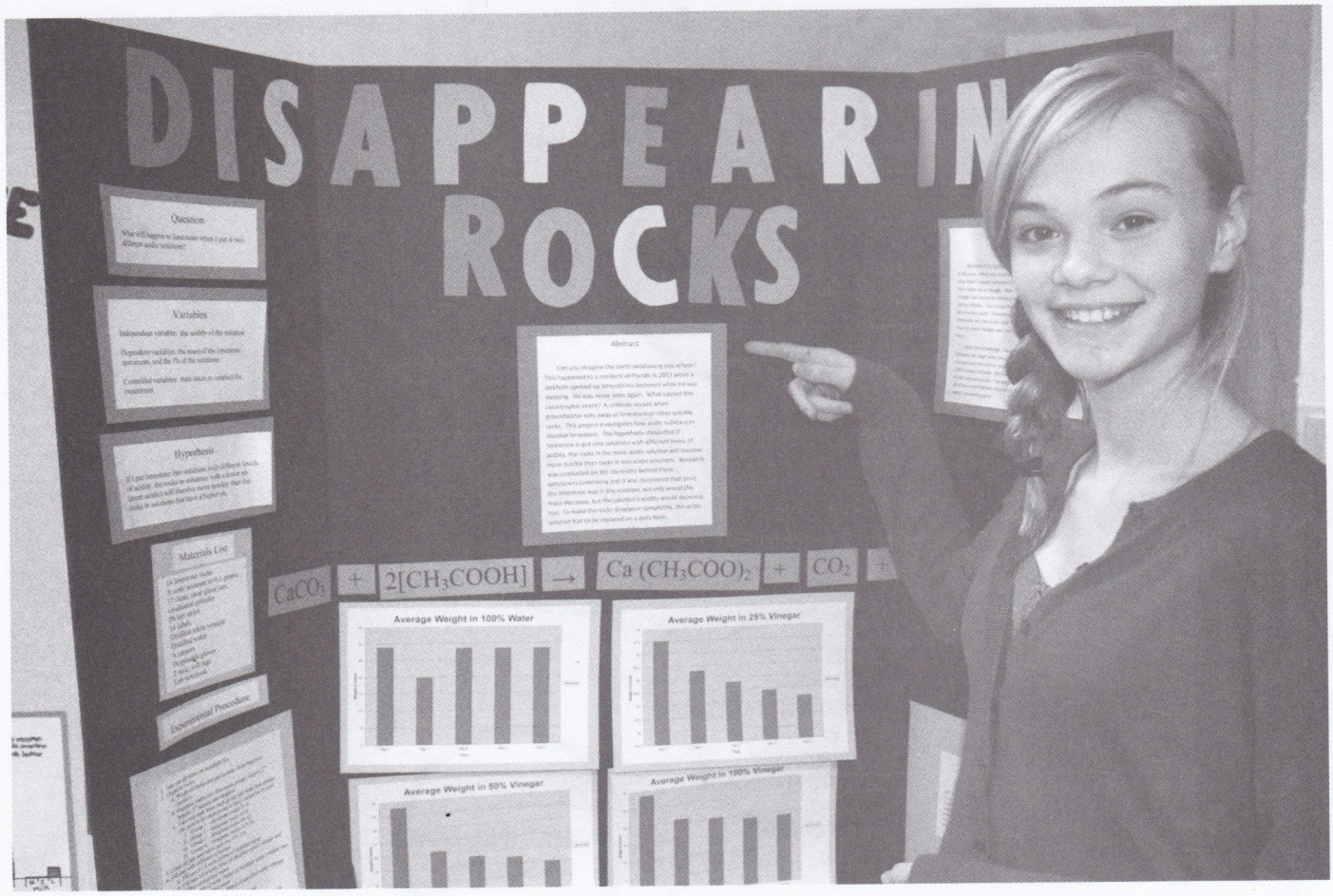
weeks 11–15

113

Classical Acts & Facts
Science
Cards

SCIENCE FAIR QUESTIONS

1. What is the purpose of your project and what do you want to learn from it?
2. Explain the background of your subject.
3. Explain the specific procedure for your experiment.
4. Explain which variables were kept the same and which single one you varied.
5. Provide the results of your experiment (include graphs, tables, illustrations).
6. What was difficult about the experiment? What mistakes did you make?
7. What are your conclusions from the project? What did you learn?

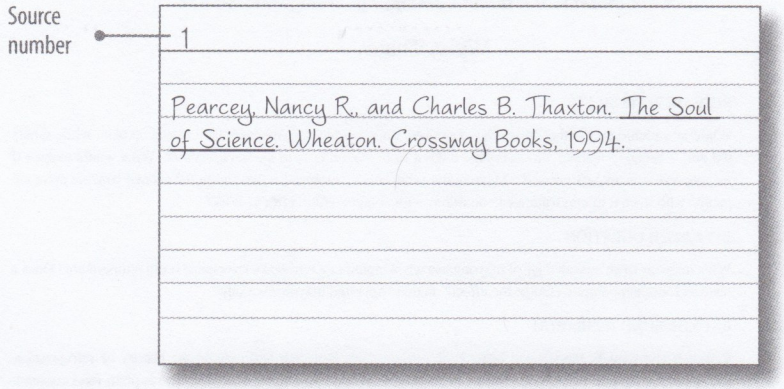


More help for your Science Fair can be found at www.SCIENCEBUDDIES.org; click on the "Project Ideas" tab.

HELP! I HAVE TO KEEP A LAB JOURNAL.

The ***lab journal*** is a vital component of study and inquiry and is used in all phases of the Science Fair project. Use it regularly and write down everything, even if it seems insignificant. Jot down phone numbers, contacts, sources, supplies, prices, diagrams, and notes from seminar. Include graphs, figures, tables, and calculations. Don't forget to note any brainstorming of questions, ideas, and hypotheses.

Bibliography Cards

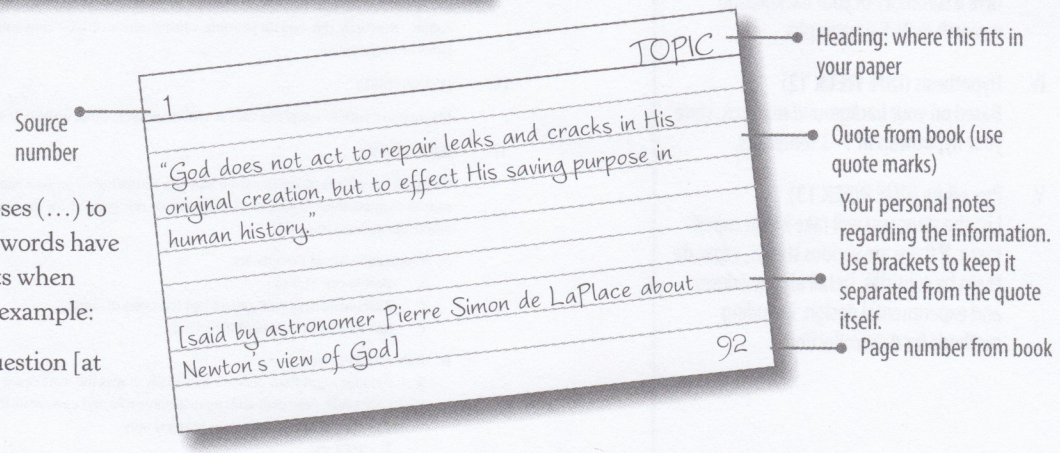


Research Cards

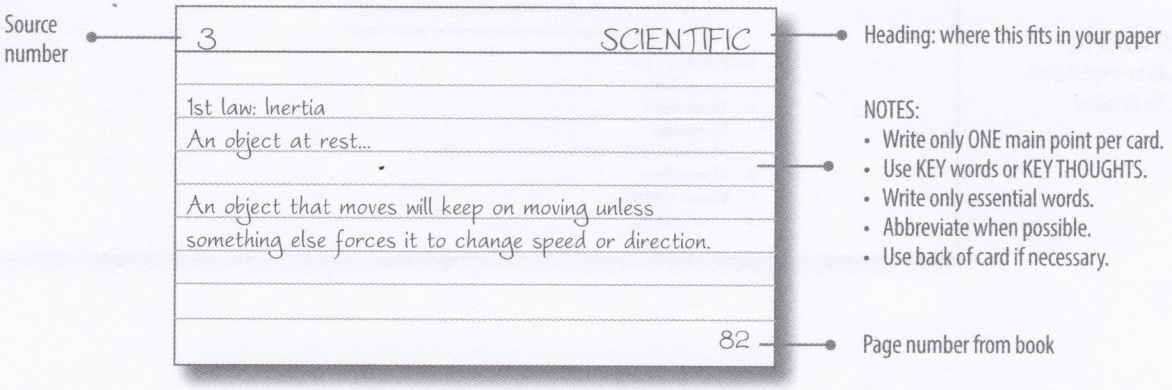
Quote Cards

When using quotes, use ellipses (…) to indicate where non-essential words have been left out, and use brackets when adding your own words. For example:

"To be or not… that is the question [at hand]."



Fact Cards



RESEARCH

RESEARCH PLAN OR PAPER TEMPLATE

Below is a simplified version of a Research Plan/Paper for the Science Fair. The purpose of a research plan is to collect information in order to better understand the results of experimentation. The research plan forms the building blocks for the research paper to be finalized upon completion of experimentation.

I. Research Problem (**DUE WEEK 11**)
Give a brief description of the problem in 1–2 paragraphs.

II. Research Question (**DUE WEEK 12**)
List the question you plan to answer.

III. Background Research (**DUE WEEK 12**)
Give a summary of your background research in 3–5 paragraphs.

IV. Hypothesis (**DUE WEEK 12**)
Based on your background research, state your hypothesis in 1–3 sentences.

V. Procedure (**DUE WEEK 13**)
List the steps you will take in the experiment. If there are various stages, separate them by subtitles. Detail all procedures and experimental design, including methods for data collection.

VI. Materials List (**DUE WEEK 14**)
List the materials to be used during experimentation. Be detailed.

The Care and Keeping of Mayonnaise

Wyiss Thate

I. RESEARCH PROBLEM

While at a picnic on a rather warm day, I noticed some people kept mayonnaise in their coolers, while others did not. I began to wonder why everyone did not store mayonnaise in the same manner. What would happen if mayonnaise was not refrigerated? Mayonnaise producers recommend refrigeration for opened jars, but there are people who store it in unrefrigerated conditions with no apparent ill effects. Why?

II. RESEARCH QUESTION

What happens to an unsealed jar of mayonnaise when stored in a refrigerator versus at room temperature? Does a warmer room temperature change the effect? Is unrefrigerated mayonnaise safe?

III. BACKGROUND RESEARCH

Research and explain the science behind the refrigeration. Research and explain the history of refrigeration. Research and explain food preservatives and commercial food packaging. Research and explain food contamination. Research and explain possible adverse effect of food contamination. Research and explain the different types of mayonnaise.

IV. HYPOTHESIS

Mayonnaise with fewer preservatives will degenerate more quickly if left unrefrigerated.

V. PROCEDURE

Compare the effects of refrigeration and non-refrigeration on two brands of mayonnaise, one with more preservatives than another. A sample of each will be refrigerated for the control group. A sample of each will be left unrefrigerated and observed.

A. Preparation of the Petri dishes
   a. Boil ¼ cup of water.
   b. Add one teaspoon of gelatin and teaspoon of sugar.
   c. Stir for one minute until dissolved.

B. Label the Petri dishes
   a. Arrange eight Petri dishes horizontally across the work space.
   b. Label each petri dish with its respective role and content as follows:
      1. PT1: Control—contains bacteria only
      2. PT2: etc.

C. Make observations of the room-temperature mayonnaise at regular intervals, as follows:
      1. Note any changes in color, consistency, or smell
      2. Extract sample for observation under microscope.

VI. MATERIALS LIST
   a. 8 petri dishes
   b. Thermometer
   c. Microscope
   d. *Heckman's*, *Earls*, and *Never-Rot* mayonnaise
   e. Kitchen Time
   f. Camera with flash
   g. 4 metal spoons

VII. RISK AND SAFETY

When working with mayonnaise it is important to protect hands and feet from unintentional contamination. Use gloves and eye protection at all times. It is critical to dispose of cultured mayonnaise properly. All cultures must be disposed of by autoclaving or by using a bleach solution before disposing of cultures. These precautions are used to make sure that nothing dangerous is being used that could cause illness in the experimenter or supervising individuals doing the experiment. It is also to ensure that nothing dangerous is released into the environment that could cause illness to the public or animals, or harm the environment.

VIII. DATA ANALYSIS METHOD

I plan to record use a table in my lab book to record the square inches of daily rot in the various brand of mayonnaise collected. The temperature will remain a constant 65 degree Fahrenheit. Additionally, I will take pictures of each sample on the hour for three days.

IX. BIBLIOGRAPHY

"Preservatives Around Us." *FDA.gov*. U.S. Food and Drug Administration, 2014. Web, 8 April 2016.

Smith, Larry. *Is Your Refrigerator Running?* West End: Random Publishing. 2001, Print.

ADDITIONAL SECTIONS (for the final Research Paper):

X. ANALYSIS OF DATA OR RESULTS (due spring semester week 1)

According to my experiments, the *Never-Rot* brand of Industrial Mayonnaise stayed free of mold for approximately 29% longer period of time over the *Earls* and *Heckmans* brand. *Earls* remained mold-free for only 10% of the tested time.

Never-Rot Days unrefrigerated	SAMPLE NR1	SAMPLE NR2	SAMPLE NR3	SAMPLE NR4	SAMPLE NR5
0	0				
0.5	0				
1.0	0				
1.5	.250				
2.0	.850				
2.5	3.53				

XI. CONCLUSIONS (due week 1)

My hypothesis was that mayonnaise with fewer preservatives will degenerate more quickly if left unrefrigerated. My results support my hypothesis.

I think the test when smoothly and I had no major problems, except that apparently my dog really likes mayonnaise and kept eating my samples. Additionally, it took several days for the *Never-Rot* brand to begin rotting. I needed to complete several trials to verify my results.

An interesting future study might be to involve testing several brands of mayonnaise at different temperatures to simulate summer and winter conditions.

I would like to thank my parents for helping me complete this project on time.

VII. Risk and Safety (**DUE WEEK 14**)
Identify any potential risks and safety precautions needed.

VIII. Data Analysis Method (**DUE WEEK 14**)
Describe the procedures or method used to analyze the data or results that answer the question or hypothesis.

IX. Bibliography (**DUE WEEK 12**)
List the resources used for background research and any other sources used in the project. Include any books, encyclopedias, dictionaries, articles, newspapers, journals, magazines, or web pages. Use properly-formatted citations (either MLA or APA).

To convert this research plan into a final research paper, add the following sections after experimentation is complete:

X. Analysis of Data or Results
(**DUE 2nd SEMESTER, WEEK 1**)
Give a 1–3 paragraph summary of the results, including data tables (graphs or charts).

XI. Conclusions
(**DUE 2nd SEMESTER, WEEK 1**)
Give a 1–3 paragraph summary conclusion of the experiment and findings, including what you might do differently or how you might continue the project in the future.

RESEARCH

SCIENCE FAIR PROJECT SCHEDULE

Item	Week Due	Date	Complete
RESEARCH PROBLEM: Bring ideas for your science fair project. Think of a problem you might like to investigate. Add to Research Plan. • Bring lab book to community.	11		
RESEARCH QUESTION: Finalize your question. Add to Research Plan, and bring a typed copy.	12		
BACKGROUND RESEARCH: Do background research on the science behind your question/topic. • Cite all sources used in bibliography format. • Take notes in lab book. • Add to Research Plan. Bring to community.	12		
HYPOTHESIS: Develop Hypothesis (based on background research). Add to Research Plan. Bring typed copy for final approval.	12		
PROCEDURE: Type up step-by-step procedures for your experiment. Add to Research Plan. Bring to community for review.	13		
MATERIALS LIST: Make materials list. Add to Research Plan. Gather materials needed for the experiment. Bring typed final Research Plan for review (see Research Plan Template on previous pages). The RESEARCH PLAN includes all of the following: problem a properly-formed question background research hypothesis procedure materials list risk and safety precautions data analysis method bibliography from research	14		
EXPERIMENTATION: Test Hypothesis by conducting experiment. Keep detailed, accurate records in lab book during the process. Repeat to verify results. Bring lab book to community.	15		
DATA ANALYSIS: Analyze data and draw conclusions. Bring the following to community: 1) Final Research Paper (Research Plan plus a summary of how you conducted the experiment, the results, and the conclusion--see template). 2) Final Abstract – no more than 250-word summary of the question, hypothesis and conclusion (if required by fair).	1		
Bring Completed Project Board and all of your documentation to community. Be prepared to practice part of your presentation. PEER REVIEW THIS WEEK!!	2–3		
All items for **Science Fair project must be complete**. Be prepared to demonstrate your project to community.	4		

Science Fair Judge's Form

_____
Student's Name

1. Research Paper (15 points) _____

- ☐ Introduction
- ☐ Research
- ☐ Bibliography

2. Presentation Board (15 points) _____

- ☐ Hypothesis
- ☐ Data, Charts, Pictures
- ☐ Conclusion

3. Science Log (15 points) _____

- ☐ Place where ongoing notes or research was recorded

4. Interview (15 points) _____

- ☐ Understands Project
- ☐ Good Speaking Skills

5. Demonstrate Project (15 points) _____

- ☐ Photos
- ☐ Model

6. Qualities (25 points)

- Originality _____
- Clear Explanation _____
- Good Presentation _____
- Time and effort spent on project _____
- If they did an experiment, did they follow the scientific method? _____

_____

Comments to help improve entry: