

Science Project Idea Search

Look through the lists of science project ideas on your science teacher's website and the DMS Library website. Take your time and think about the type of project that would be interesting to you.

Some categories to consider:

- Behavior and Social Science
- Botany
- Chemistry
- Computer Science
- Consumer Science
- Earth and Space Science
- Engineering
- Environmental Science
- Mathematics
- Health and Medicine
- Microbiology
- Physics
- Zoology

Choose at least three project ideas and write the web address for each so that you can access them in the future.

1. Idea -

Web address -

2. Idea -

Web address -

3. Idea -

Web address -

Parent Signature _____

Research Plan for Science Project

Problem (What question do you want to ask?)

Hypothesis (What do you think will happen? Why do you think this will happen?)
(If you are doing an engineering project, state your goals for the project.)

Materials List (What type of equipment and materials will you need to complete your experiment?) Be specific.

Procedure

Identify the **independent variable** (What will you change?)

Identify the **dependent variable** (What may change as a result of changing the independent variable?)

Identify the **control** (What you will set up to compare)

Collecting Data and Observations - Tell how you will measure any changes

Procedure (Write the steps of your experiment. What will you do?)

Bibliography – at least five references where you found information (this can be a web address, book, newspaper, magazine or encyclopedia)

1.

2.

3.

4.

5.

Research – Write at least five facts or pieces of information about your topic as a start for your research paper.

1.

2.

3.

4.

5.

Scientific Logbook

Students must keep a logbook of their experiment. A log book is a single subject, bound notebook in which all of the records of the experiment are kept. The logbook will become part of the science fair display, along with the board and the research paper. It is the piece of information that the student will refer to if something about the experiment has to be double checked. The logbook can also be referred to when writing the research paper. Judges will want to see the original logbook. Don't rewrite it if it is not neat. Judges look for evidence that the logbook was used every time a part of the experiment was worked on.

What to put in your logbook:

- Data Entries – every entry should be **dated** and written on a **separate page**. You should **number each page** up in the corner. Whether the entry is made daily or only once a week will depend on your experiment. Every time you do part of your experiment, you should make a new page. Write or print so you can read it!
- The final plan of the experiment – once you have settled on the final plan, called the **research plan**, for your experiment, you should write it in your logbook for reference.
- Include gathering materials together, borrowing or buying things you need for the project. Record the cost of materials and where you purchased them.
- Description of setting up your experiment – write a detailed account of what was done in setting up the experiment. Be sure to write down the date when you begin the experiment. Describe everything that you do and everything that happens. Write it down immediately, while you still remember and the details are fresh in your mind.
- Ideas and questions – an idea may occur to you while you are working. Write it down in your logbook. You may not see any immediate use for the idea, but if you record it, it may be important later. If you have a question, write it down so you can look up the answer when you have a chance.
- Problems or weak parts of the experiment – your investigation may have weak spot that you didn't know about when you started. Write them down as you discover or realize them. If your experiment is repeated, the weak spots can be corrected or compensated for. When you report your results, these weak spots should be listed and explained. If some of the ways you are measuring are not working well, write it down so you can make a change.
- Charts and tables of data – the tables and charts where you record your measurements may be the basis of the charts, tables and graphs that you make for your display board and include in your research paper. Label accurately.

The Scientific Method

A science project is an investigation using the scientific method to discover the answer to a scientific problem. Before starting your project, you will need to understand the scientific method. The scientific method is the “tool” that scientists use to find the answers to questions. It is the process of thinking through the possible solutions to a problem and testing each possibility to find the best solution. The scientific method involves the following steps:

- **Doing research**
- **Identify the problem (in question form)**
- **State the hypothesis**
- **Conduct an experiment**
- **Observe and record your data**
- **Reach a conclusion**

Doing Research

Research is the process of collecting information from your own experiences, knowledgeable sources, and data from exploratory experiments. Your first research is used to select a project topic. This is called **topic research**. For example, you observe a black growth on bread slices and wonder how it got there. Because of this experience, you decide to learn more about mold growth. Your topic will be about fungal reproduction.

After you have selected a topic, you begin what is called **project research**. This is research to help you understand the topic, express a problem, propose a hypothesis, and design one or more project experiments- experiments designed to test the hypothesis. Investigate what others have already learned about your question. The result of this experiment and other research give you the needed information for the next step – identifying the problem.

- Do use as many references from printed sources – books, journals, magazines, and newspapers – as well as electronic resources – computer software and online services.
- Do gather information from professionals – instructors, librarians, scientists, such as physicians and veterinarians.
- Do perform other exploratory experiments related to your topic.

Identify the Problem

The problem is the scientific question to be solved. It is best expressed as an “open-ended” question, which is a question that is answered with a statement, not just yes or no. These questions may begin with the word how, why, or when but shouldn’t begin with the word does or is.

- Do limit your problem
- Do choose a problem that can be solved by performing an experiment.

State a Hypothesis

A hypothesis is an idea about the solution to a problem, based on knowledge and research. While the hypothesis is a single statement, it is the key to a successful project. All of your project research is done with the goal of expressing a problem, proposing an answer to it (the hypothesis), and designing project experimentation. Then all of your project experimenting will be performed to test the hypothesis. The hypothesis should make a claim about how two factors relate. Here is one example of a hypothesis: “I believe that bread mold does not need light for reproduction on white bread. I base my hypothesis on these facts: (1) organisms with chlorophyll need light to survive. Molds do not have chlorophyll and (2) in my exploratory experiment, bread mold grew on white bread kept in a dark bread box.”

- Do state facts from past experiences or observations on which you base your hypothesis.
- Do write down your hypothesis before beginning the project experimentation.

- Don't change your hypothesis even if experimentation does not support it. If time permits, repeat or redesign the experiment to confirm your results.

Conduct an Experiment

Project experimentation is the process of testing a hypothesis. The things that have an effect on the experiment are called variables. There are three kinds of variables that you need to identify in your experiment: independent, dependent, and controlled. The **independent variable** is the variable that you purposely manipulate (change). The **dependent variable** is the variable that is being observed, which changes in response to the independent variable. The variables that are not changes are called **controlled variables**.

A controlled is a test in which the independent variable is kept constant in order to measure changes in the dependent variable. In the control, all variables are identical to the experimental setup – your original setup – except for the independent variable. Factors that are identical in both the experimental setup and the control setup are the controlled variables.

Scientists run experiments more than once to verify that results are constant. Each time that you perform your experiment is called a run or a trial. As it is best to perform an experiment more than once, it is also good to have more than one control. You might have one control for every experimental setup.

- Do have only one independent variable during an experiment.
- Do repeat the experiment more than once to verify your results.
- Do have a control.
- Do have more than one control, with each being identical.
- Do organize data.

Reach a Conclusion

The project conclusion is a summary of the results of the project experimentation and a statement of how the results relate to the hypothesis. Reasons for experimental results that are contrary to the hypothesis are included. If applicable, the conclusion can end by giving ideas for further testing.

If your results do not support your hypothesis:

- DON'T change your hypothesis.
- DON'T leave out experimental results that do not support your hypothesis.
- DO give possible reasons for the difference between your hypothesis and the experimental results.
- DO give ways that you can experiment further to find a solution.

If your results do support your hypothesis:

You might say, for example, "As stated in my hypothesis, I believe that light is not necessary during the germination of bean seeds. My experiment supports the idea that bean seeds will germinate without light. After seven day, the seeds tested were seen growing in full light and in no light. It is possible that some light reached the 'no light' containers that were placed in a dark closet. If I were to improve on this experiment, I would place the 'no light' containers in a light-proof box and/or wrap them in light-proof material, such as aluminum foil."

Non Inquiry Based Research

Not all areas of study are best served by scientific research. Because engineers, inventors, mathematicians, theoretical physicists and computer programmers have different objectives than those of other scientists, they follow a different process in their work. The process that they use to answer a question or solve a problem is different depending on their area of study. Each one uses their own criteria to arrive at a solution.

Engineering Projects

“Scientists try to understand how nature works; engineers create things that never were.” An engineering project should state the engineering goals, the development process and the evaluation of improvements. Engineering projects may include the following:

1. Define a need or “How can I make this better?”
2. Develop or establish design criteria (could be more than one)
3. Do background research and search the literature to see what has already been done or what products already exists that fill a similar need. What makes them good and what makes them weak?
4. Prepare preliminary designs and a materials list. Consider cost, manufacturing and user requirements.
5. Build and test a prototype of your best design. Consider reliability, repair and servicing.
6. Retest and redesign as necessary. Product testing.
7. Present results.

Computer Science Projects

These often include creating and writing new algorithms to solve a problem or improve on an existing algorithm. Simulations, models or ‘virtual reality’ are other areas on which to conduct research.

Mathematics Projects

These involve proofs, solving equations, etc. Math is the language of science and is used to explain existing phenomena or prove new concepts and ideas.

Theoretical Projects

These projects may involve a thought experiment, development of new theories and explanations, concept formation or designing a mathematical model.

Preparing an Abstract

What is an Abstract?

An abstract is a summary of your project. It is not just a general description. After finishing research and experimentation, you will write:

- A 250-word
- A one page abstract printed on a single sheet of paper
- It will be in the form of a three paragraph essay
- You will attach it to the lower right hand corner of your science project board
- If you are not entering your project into the fair, you will hand in your abstract after you have presented your project to the class

The following should be included in your abstract:

- Title – “Title of your project – Abstract”
- **Paragraph 1 – Purpose:** The purpose states the usefulness of the study. It answers the question why you chose the project.
- **Paragraph 2 – Procedure:** The procedure gives a brief summary of what you did; you can explain step by step how you did your experiment. **Data:** What actually happened? You do not need to put graphs, charts or tables for this. They will appear on your project board and in your research paper. Just explain what kind of measurements you obtained.
- **Paragraph 3 - Conclusion:** The conclusions provide a statement about the results of the investigation. Did you prove or disprove your hypothesis? You can also identify unsolved aspects of the original problem or any new problems identified. You should also include any possible future research uses for your findings.

Do not include your name, school, acknowledgements (thank you's) or any work/procedures done by a lab scientists or teacher that may have helped you.

- **Abstract must be typed.**
- **Abstract is limited to one page.**
- **It must be located on your display board in the lower right corner.**
- **Use the Chart on page 7 & 8 to help you write the abstract.**

Abstract Outline

Which Type of Wood Shows the Best Resistance to Dents and Nicks?

First Paragraph introduces your purpose. Follow the script.

The purpose of my science fair project is to ... (Tell the usefulness of the experiment. Answer the question WHY you choose the project.)

This is an organizer. The purpose is to be typed as a paragraph on your final project.

The second paragraph is about the procedure you followed. Notice the transition words. Use them as you explain the steps of your experiment. Include data which means what actually happened. Explain the kind of measurements you obtained.

To conduct my experiment, I first...

Next

Then

After

Once

Then

This

This is an organizer. Type the procedure as a paragraph on your final copy.

The last paragraph states the results of your experiment.
Yes, I proved my hypothesis because...
No, I didn't prove my hypothesis because...

I found that ...

Finally, ... (explain how this could be used for future applications)

This is an organizer. Type the procedure as a paragraph on your final copy.

Format Requirements

- Three paragraphs (purpose, procedure, conclusion)
- Double Spaced
- One Page
- Edit for Spelling and punctuation
- Attach to the lower right hand corner of your science project
- No name, school, acknowledgements, or work done by lab scientist who helped you.

How to Prepare Your Research Paper

At this point, you are in the home stretch. Preparing your research paper will involve pulling together the information you have already collected into one large document. Your research should include the following and make a separate page for each section.

- **TITLE PAGE** - Includes your project title. This is the cover page for your research paper. You can put a graphic or picture, but DO NOT include your name or teacher's name. (Your name goes on the back)
- **TABLE OF CONTENTS** - Include this page with a list of sections and a page number for the beginning of each section.
- **INTRODUCTION** - The introduction sets the scene for your report. The introduction includes stating the problem, your hypothesis, an explanation why you chose your project and what you hoped to achieve. Look at your research plan page. Your research plan will help you write your introduction.
- **LITERATURE REVIEW** – This is the background information that you found in your research. These can be the facts or pieces of information about your topic that you wrote in your logbook. Tell what you read about when doing your research. You may have read information from internet sources, books or other printed material. In the literature review, you are providing the reader with useful background information for your project.
- **EXPERIMENT** - Describe in detail the methods used to collect your data or make your observations. It should be detailed enough so that someone could repeat the experiment from the information in your paper (like a recipe). Refer to your logbook for this information, because you wrote everything down in your logbook as you performed the experiment.
- **DISCUSSION** - This is the main part of your research paper. When you are composing your discussion, your results should flow smoothly and logically from your data. Look at your logbook for this information. Be thorough. Allow your reader to see your train of thought, letting them know exactly what you did. Compare your results with published data that you may have found in your literature review, commonly held beliefs and/or expected results (your hypothesis). Include a discussion of possible errors. Did the data change much when you repeated your experiment again? Were your results affected by uncontrolled events? What would you do differently if you repeated this project? What other experiments should be conducted if you were going to work on this project again next year?
- **CONCLUSION** - Briefly summarize your results. Be specific, tell if your results agreed or disagreed with your hypothesis. You will get this information from your logbook. Do not put anything in the conclusion that has not already been discussed somewhere else in your project.
- **ACKNOWLEDGEMENTS** - (Optional) you should always give credit and thank to those who helped you. Identify any materials you received or borrowed from someone, but do not mention any names. You do not need to put this on our display board.

- **REFERENCES** – You may call this page your list of Reference or Bibliography or Work Cited and it should include any information that is not your own. This includes books, journal articles, internet, magazines, interviews, etc. For your project, you should have a least five references that you actually used. Follow the proper bibliography format, found on the DMS Library website under “Citation,” prepared by our librarian Mrs. Bisirri.
- **TABLES AND FIGURES** - Include tables, charts and photographs that further help explain your experiment. You will find the original information for these in your logbook. Prepare charts, graphs and tables on a computer. Make sure you label the x-axis and y-axis and give your chart a title.

These pages should be hole-punched and placed in a folder. You will display this research paper in front of your project board.

References, Bibliography or Works Cited

Don't Forget:

- Double space the page
- Use the title "References," "Bibliography," or "Works Cited" at the top of the page
- List your sources in alphabetical order by author (or title if there is not author)
- Use a hanging indent for each entry (the first line of every entry should be at the margin, the next line of it should be a indented ½ inch)
- Follow MLA punctuation carefully

Works Cited

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<http://owl.english.purdue.edu/owl/resource/747/01/>

This website provides step-by-step directions and examples for different types of sources.

Writing a Conclusion

Follow the script and write the conclusion in paragraph form.

Conclusion Outline

As stated in my hypothesis, I believe/think...

(write your hypothesis)

After completing my experiment I found that my hypothesis was (correct/incorrect or right/wrong) because ...

(list the reasons why)

If I were to do this experiment again, I would ...

(write what you would do the same or different or if you would do it again and why?)

Helpful Hints for Designing Your Display Board

You want to attract and inform. Make it easy for interested spectators and judges to access your study and the results you have obtained. Make the most of your space using clear and concise displays. Make headings stand out, and design graphs and diagrams clearly label them correctly. Leave your glassware and chemicals at home.

Good Title

Your title is an extremely important attention-grabber. A good title should simply and accurately present your research. The title should make the casual observer want to know more.

Take Photographs

Many projects involve elements that may not be safely displayed at the fair, but are an important part of the project. You might want to take pictures of important parts/phases of your experiment to use on your display. If you put pictures of other people, you must have their consent. Do not put any pictures of yourself on your display board.

Be Organized

Make sure your display is logically presented and easy to read. A quick glance should allow anyone to locate the title, the experiment, the results, and the conclusions. When you arrange your display, imagine you are seeing it for the first time.

Pay Attention to Detail

Be sure to adhere to size limitations and safety rules when building your display. Make sure it is sturdy so it will last a long time. Make sure that your name is on the back of your display board.

Be Creative

Make your display stand out. Use colorful headings, charts, and graphs to present your project. Pay attention to the labeling of graphs, charts, diagrams, and tables. Each item should have a descriptive title. Anyone should be able to understand the visuals without further explanation.

Make Sure Your Abstract is on Your Board

All display boards must have the abstract posted in the lower right corner of the board.

Proofread

Make sure to carefully review all of the materials you put on your display board.

Table Space

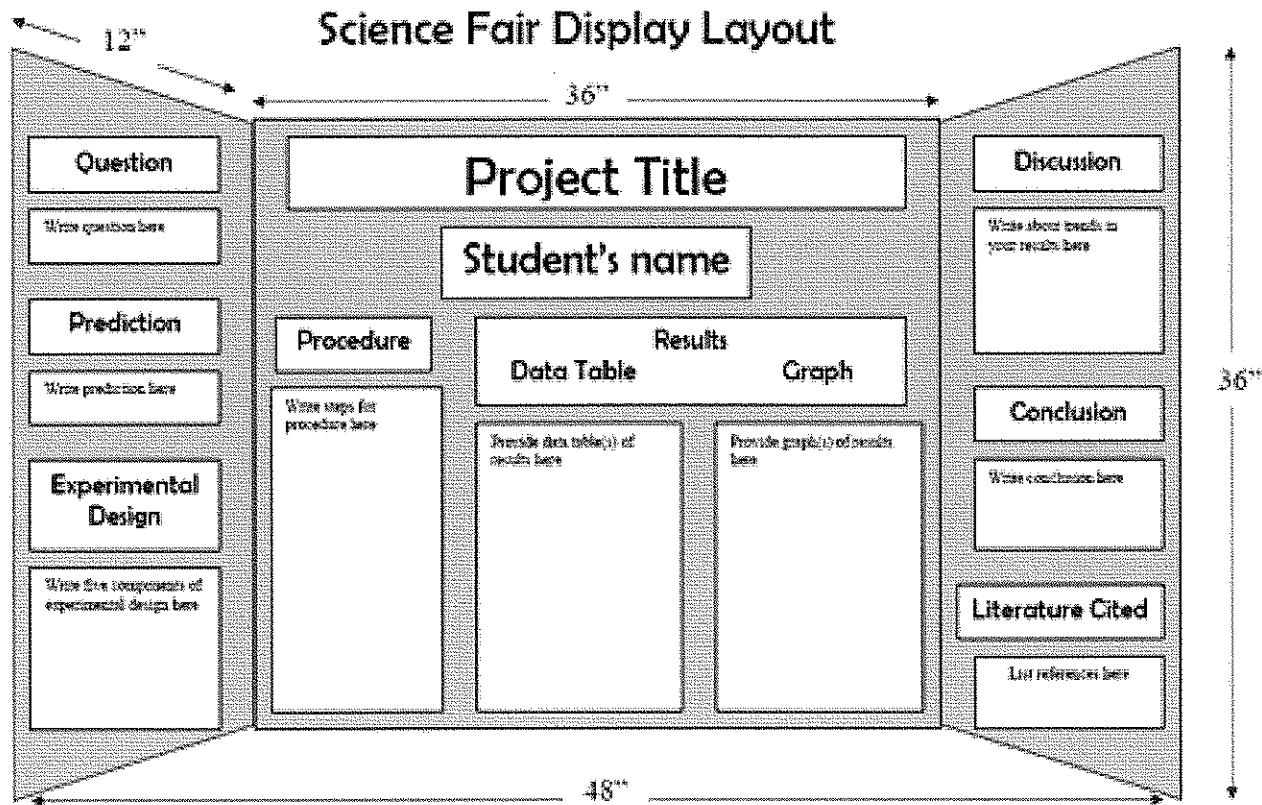
Don't forget the table space. You may have more than just the display board to show off your project. You should also include your logbook, research paper, and any appropriate models on the table space in front of your display.

Do Not Use Double Sided Tape

Rubber Cement works well, make sure you have parent supervision.

Fill in Empty Spaced on your Board with pictures or diagrams

The Display



A Sample Display Board – Does not have to be exactly like the diagram above.

DO:

- Use computer-generated graphs
- Display photos representing the procedure and the results
- Use contrasting colors
- Limit the number of colors used
- Display models if possible
- Attach your charts neatly
- Balance your materials on your display board, distribute them evenly

DON'T:

- Leave large empty spaces on the display board
- Leave the table in front of your display board empty
- Make your title difficult to read
- Hand-print letters on your display board
- Attach folders that fall open on the display board
- Make mistakes in spelling words
- Have faces in any pictures on your board
- Do not write directly on the board

A Parent's Role in the Science Project

- Encourage, support, and guide your child
- Make sure your child feels it is his or her project
- Make sure work is done primarily by the child
- Realize the main goal of the science project is to help your child use and strengthen the skills he or she has learned (especially the scientific method) and develop higher level thinking skills
- Help your child find information by providing rides to libraries or other sources of information
- Help your child use the internet
- Be sure your child is properly supervised and the project is safe
- Develop and follow a timeline to prevent "last minute projects"
- Feel a sense of pride and accomplishment when the project is complete, you and your child have