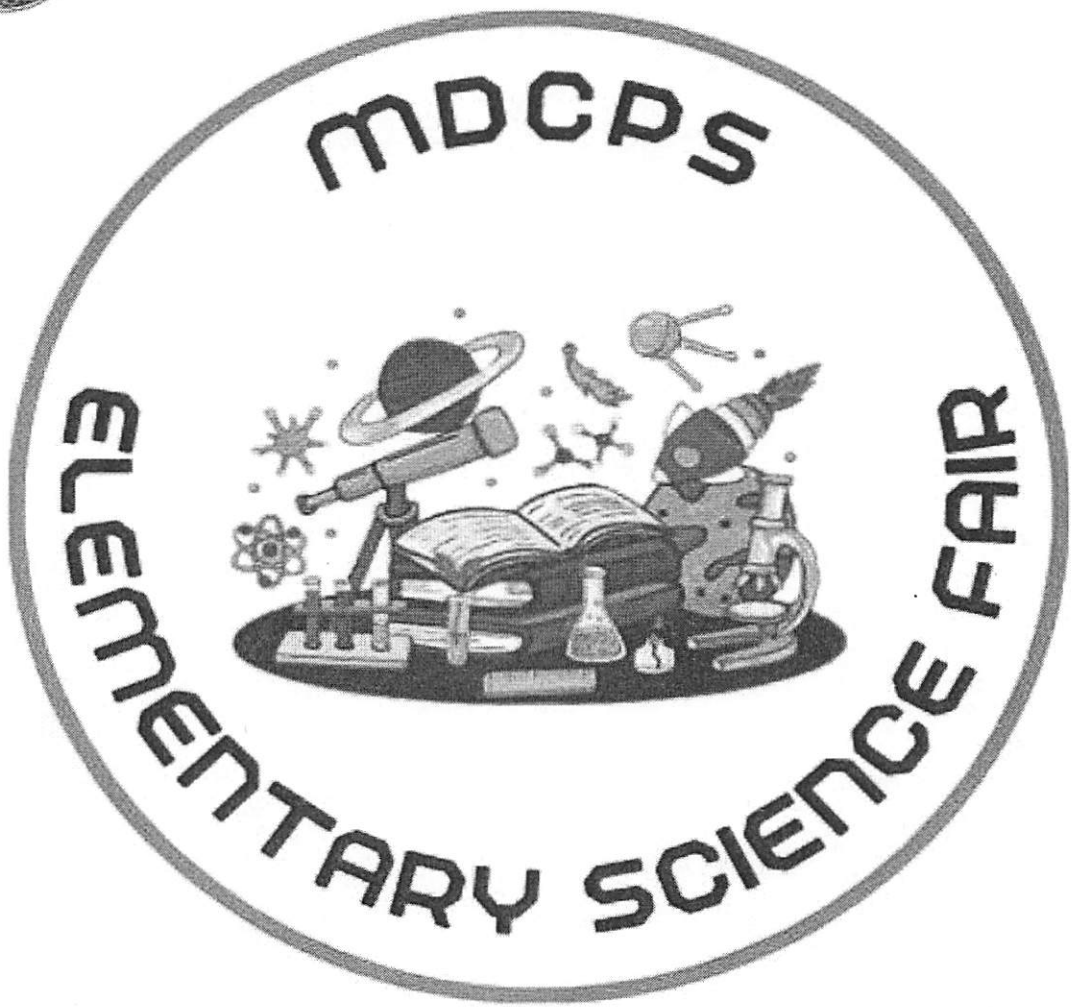


2023 - 2024

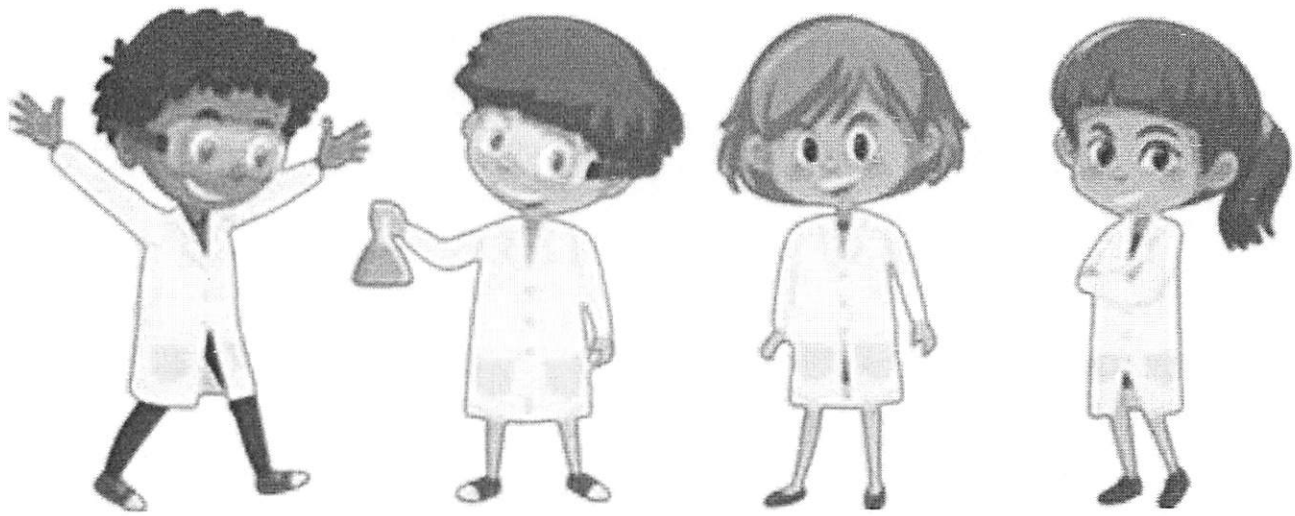
Science Fair

Resources, Required Forms, and Planning Guides

Table of Contents

RESOURCES AND FORMS:

STUDENT PLANNING GUIDES:



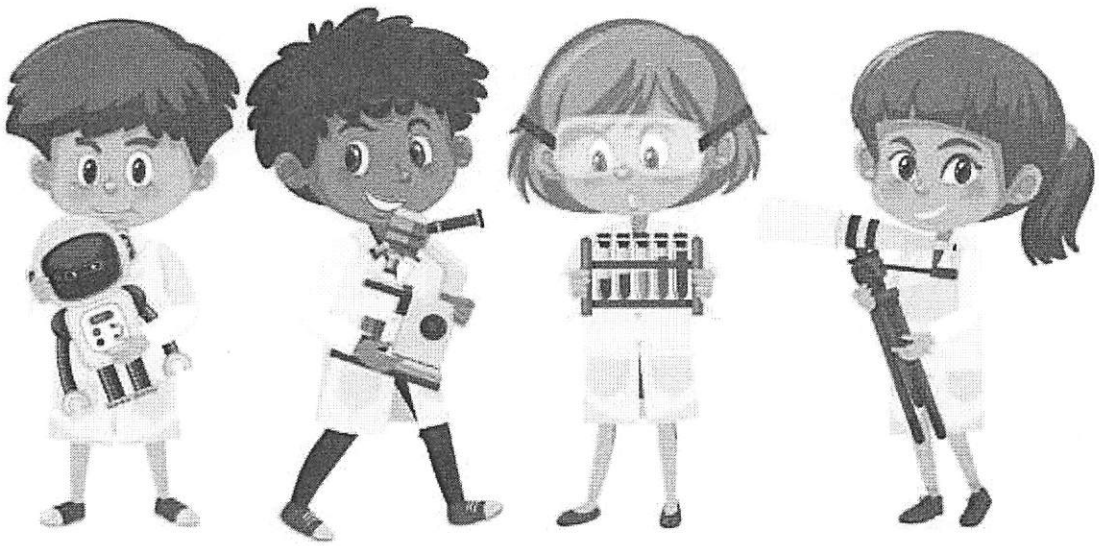
Types of Projects

1. **SCIENTIFIC INVESTIGATION**: In this type of experimental project, you ask a question in the form of a *problem statement*, construct a *hypothesis*, test your hypothesis using an *experiment*, and draw *conclusions* from your experiment. It involves using **the scientific method.**

- **Experiment:** In this kind of investigation, your purpose is to change something (test or independent/manipulated variable) and record the outcome of this change (outcome or dependent/responding variable). EXAMPLE: Which material, aluminum foil or plastic wrap, will insulate cold water better?

- **Experiment with a Control Group**: This kind of investigation involves a more complex investigation designed to test the effects of a single condition or factor on a system. For example, you might have a group of plants as an experimental group and another group of the same type of plants as a control group. This experiment's test or independent variable is the amount of chemical fertilizer added only to the experimental plant group. No fertilizer would be added to the control group. Both the control and experimental groups have the same constants (the normal conditions), such as the amount of water and the sunlight. The outcome or dependent variable is the difference observed in the growth of the plants.

2. **ENGINEERING/INVENTION**: These projects must fit into the following categories:
- **Engineering**: Projects can ***redesign*** technological devices which are useful to the global society within an engineering-related field, such as electricity, mechanical, chemical, aeronautical, and geological.
- **Inventions**: Projects that use design and engineering processes to find a ***new*** practical solution to a problem that exists.



Science Fair Rules

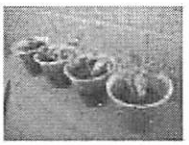
- Only individual projects are allowed.
- Only two types of projects may be entered into the District Fair: a scientific investigation or an engineering/invention project.
- Projects must fit in one of the eight (8) science fair project categories listed in this resource packet.
- **No mold, algae, fungi, or bacterial growth/testing projects are allowed.**
- **No use of vertebrate animals is allowed except for observational projects.**
- **No use of prescription drugs, or harmful, or illegal substances is allowed.** Grocery items (i.e., baking soda, vinegar, salt, lemon juice, etc.) are appropriate.
- **No human subjects can be used to test** (i.e., taste test, poking, pain reaction, sniffing, painting fingernails, chewing gum, etc.)
- Any projects that promote violence, weapons, or instill fear in the public, the exhibitor, or other exhibitors and the use of fire are **PROHIBITED**.
- Project display boards must follow the safety rules listed in this resource packet.
- ***Projects must be approved by the classroom teacher/school-level science fair committee before it is submitted to the MDCPS Science Fair. Students should complete and submit the Project Proposal form to their teacher/school-level committee.***

ELEMENTARY SCIENCE, MATHEMATICS, ENGINEERING, AND INVENTION FAIR
RUBRIC FOR JUDGING INVESTIGATION PROJECTS

1. Abstract & Bibliography: To what degree do the abstract and bibliography describe the project and support the research?	0 = No Abstract/No documentation of research 1 = Poorly written and one documentation 2 = Poorly written and two documentations of research 3 = Well-written but does not describe all components of the project 4 = Well-written and completely describes the project
2. Problem Statement: To what degree is the problem statement new and/or different for a student at this grade level, and how well is it written?	0 = No Problem Statement 1 = Incomplete Problem Statement 2 = Poorly written or not in a question form 3 = Complete a well-written Problem Statement in question form 4 = Above expectations – detailed, well-written in question form
3. Hypothesis: To what degree is this a testable prediction? Is it written in an "if...then..." statement?	0 = No hypothesis 1 = Incomplete hypothesis 2 = Complete hypothesis, but not completely testable 3 = Hypothesis is well-written and testable 4 = Hypothesis is above expectations – detailed, well-written, testable
4. Procedures: - Numbered step by step - Sentences begin with verbs - Quantities to measure are listed in metric units	0 = No overall procedural plan to confirm the hypothesis 1 = Partial procedural plan to confirm the hypothesis 2 = Sufficient procedural plan to confirm the hypothesis 3 = Well-written plan, numbered step-by-step, sentences beginning with verbs 4 = Well-written as above and detailed, including repeatability and specified measurements of materials used in the experiment
5. Variables: -Test (independent/manipulated) -Outcome (dependent/responding) -Control (if applicable) -Constants	0 = No variables or constants are recognized 1 = Some variables or some constants are recognized 2 = All variables are recognized, but not all constants and controls (if applicable) or vice versa 3 = All variables & constants, and controls (if applicable) are recognized 4 = All variables & constants, and controls (if applicable) are clearly and appropriately recognized
6. Materials and Equipment: Were the items - listed in column form? - specifically named? - listed in metric units?	0 = No materials identified or used 1 = Materials not specifically identified and/or used properly 2 = Materials specifically identified but used improperly 3 = Materials specifically identified in column form and used properly 4 = Materials specifically identified in column form & metric units used properly
7. Results: To what degree have the results been interpreted?	0 = No written narrative interpretation of data 1 = Partial written narrative interpretation of data 2 = Correct written narrative interpretation of data 3 = Comprehensive narrative interpretation of data, including averaging 4 = Comprehensive and significant interpretation of data above expectations
8. Conclusion: To what degree are the conclusions recognized and interpreted? Including: - the purpose of the investigation - the hypothesis supported/not supported - the major findings	0 = No problem statement or interpretation of data support for hypothesis identified 1 = Incomplete problem statement or interpretation of data support for the hypothesis 2 = Correct/complete conclusion/interpretation of data support for the hypothesis 3 = Well-written conclusion/interpretation of data support for the hypothesis 4 = Well-written conclusion/interpretation of data support for the hypothesis with major findings and possible explanations for them
9. Application: To what degree are the applications recognized and interpreted? Including: -Improvements to the investigation - Use of the findings - New question(s) to be investigated	0 = No recommendations, applications, or new questions recognized 1 = Incomplete or vague recommendations, applications, or new question recognized 2 = Apparent recommendations, applications, or new questions recognized 3 = Recommendations, applications, and new questions clearly recognized 4 = Significant well-written recommendations, applications, and new questions recognized
10. Final Project/ Display Attributes: - free standing - correct grammar/ spelling - clear and legible - attractive visual display	0 = Unsatisfactory quality of display - more than three attributes are missing 1 = Poor quality of display - only two or three attributes are missing 2 = Average quality- only one attribute missing with minor errors and of fair quality 3 = Good quality – all attributes present and with few if any minor errors 4 = Superior display – all attributes present and of exemplary quality
11. Oral Presentation: -How clear, well-prepared, and organized is the presentation? -How complete is the student's understanding of the experimental work?	0 = Poor presentation; cannot answer questions 1 = Poor presentation; partially answers questions 2 = Fair presentation; adequately answers most questions 3 = Good presentation; precisely answers most questions 4 = Exemplary presentation and knowledge; precisely answers all questions

Science Fair Categories

All great science projects begin with great questions. However, before starting on a great question, pick a subject or topic you like!



Botany: Projects that use subjects such as plants (seed plants or spore-producing), agriculture, conservation, and forestry. Live plants can be used for the project but cannot be displayed. **Experiments testing for algae, bacteria, mold, or fungi are NOT allowed.**

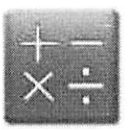
Chemistry: Projects that examine chemical reactions, the chemistry of living things, photosynthesis, solubility, heat capacity, etc. **The experiments should not use prescription drugs or dangerous or illegal substances.**

Earth and Space Science: These are projects investigating principles of geology (for example, weathering and erosion), geography, astronomy, meteorology, and related fields.

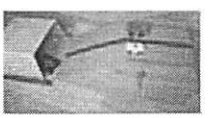
Engineering: Projects can ***redesign*** technological devices which are useful to the global society within an engineering-related field, such as electricity, mechanical, chemical, aeronautical, and geological.

Environmental Science: Projects that deal with global change and Earth-related issues, such as water, air, climate, waste and pollution, green living, human health, ecosystems, and related fields. **Experiments testing for algae, bacteria, mold, or fungi are NOT allowed.**

Inventions: Projects that use design and engineering processes to find a ***new*** practical solution to a problem that exists.



Mathematics: Projects are developed to demonstrate any theory or principle of mathematics.



Physical Science: Projects that study the nature and properties of nonliving matter, energy, and/or force and motion.

NOW IT'S YOUR TURN! DUE DATE: _____

Write down your favorite Science Fair Category from page 7 and what it is you want to learn more about:

My favorite category was _____.

I want to complete an experiment involving _____

_____

_____

_____

_____.

Helpful Websites for Investigations and Engineering and Invention Projects:

- http://science.dadeschools.net/
- http://www.sciencebob.com/sciencefair/index.php
- http://www.sciencebuddies.org
- http://sciencepage.org/scifair.htm
- http://www.ipl.org/div/kidspace/projectguide/
- www.howstuffworks.com
- http://all-science-fair-projects.com/
- Invention Ideas for School Projects That Make You Stand Out From the Rest (nevadainventors.org)
- Invention Education: 27 lessons where students are the inventors! - PBS NewsHour Classroom
- https://nevadainventors.org/invention-ideas-for-school-projects/

25 Kid-Tested STEM Projects Made With Simple Materials - Instructables

Science Fair School Contract and Proposal Form

STUDENT'S NAME: _____ **TEACHER'S NAME:** _____

Investigation *or* Engineering/Invention Idea:

Science Fair Project Question Checklist	
✓ Can you find at least 3 sources of information on the subject?	Yes / No
✓ Can you design a "fair test" to answer your investigation question or solve your problem?	Yes / No
✓ Did you read the science fair rules? Is your experiment/ engineering/invention safe to perform?	Yes / No
✓ Will you be able to obtain all the materials and equipment you need for your ✓ science fair project quickly and at a very low cost?	Yes / No
✓ Do you have enough time to complete your experiment/ engineering/invention and repeat it at least 2 more times before the school science fair?	Yes / No

I have discussed the project problem statement/engineering/invention idea and the checklist with my parent(s), and I am willing to commit to following through on this project. I further understand that failure to comply with the rules outlined in this guide will affect my final project grade.

_____

Student's Name and Signature **Date**

I have discussed the project problem statement/engineering/invention idea and the checklist with my child, and I believe he or she can follow through with this project. I further understand that failure to comply with the rules outlined in this guide will affect his/her final project grade.

_____

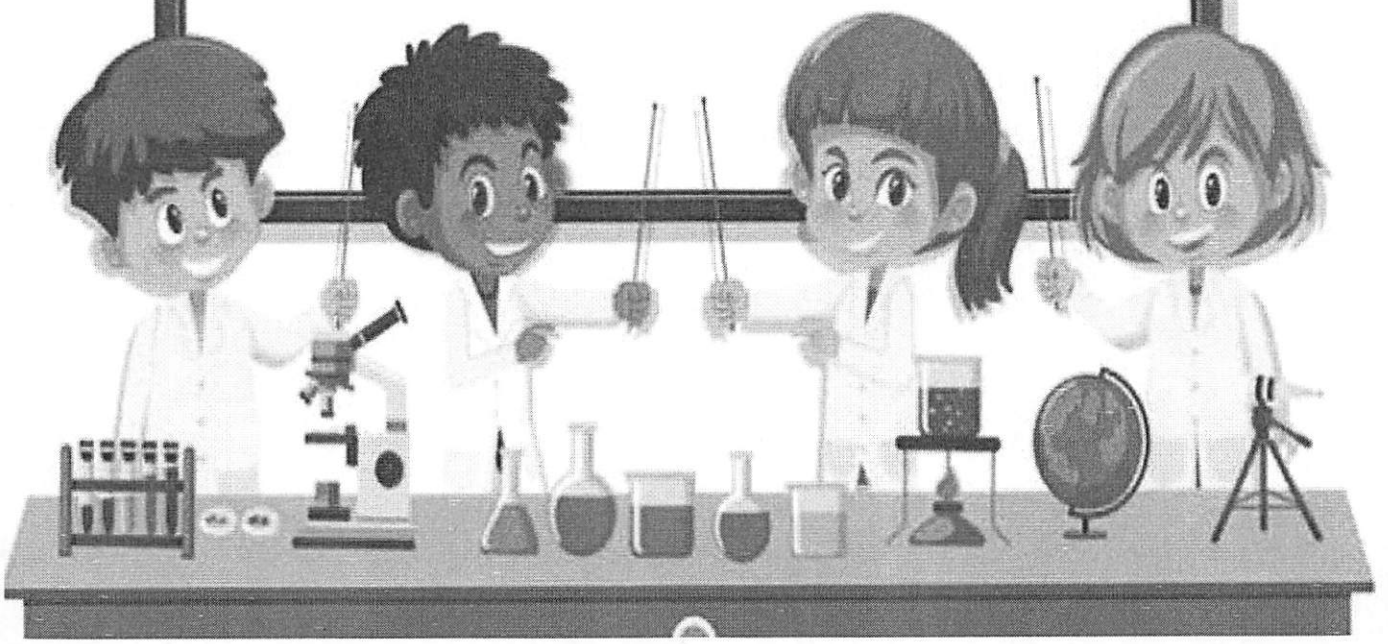
Parent's Name and Signature **Date**

I have read the proposed Science Fair Project for the above-named student and have approved his/her proposal.

_____

Teacher's Name and Signature **Date**

STUDENT INVESTIGATION PROJECTS PLANNING GUIDE



Student Investigation Project Guide

Step 1 – Think of what you would like to explore and write your Problem Statement.

Write a question or identify a problem within that topic. Here are some examples of Problem Statement questions:

What is the effect of _____ on _____?

EXAMPLES:	the amount of sunlight	the production of seeds in tomatoes
	temperature	seed germination
	lubricants	the time it takes a toy car to go down a ramp

How does the _____ affect _____?

EXAMPLES:	type of liquid	seed germination
	material of a surface	the adhesion of tape
	type of liquid	the growth of plants

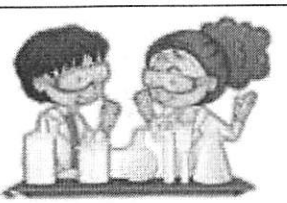
Which/What _____ (verb) _____?

EXAMPLES:	stain remover	(cleans)	a ketchup stain from cotton
	brand of battery	(powers)	a flashlight the longest
	type of plastic wrap	(prevents)	the most evaporation

NOW IT'S YOUR TURN!

DUE DATE: _____

Create your ***Problem Statement*** using either the "Effect Question," the "How does Affect Question," or the "Which/What and Verb Question."



Step 2 – Research Your Topic and Form a Hypothesis

Now that you have chosen a topic you are interested in, it is time to **research**! Read about your topic. Use magazine articles and books from the library. Search for information from the internet. You will need this information to write your **bibliography** *(see page 23)*. Please take note of any new science words you learn and use them when you write about your project.

NOW IT'S YOUR TURN! DUE DATE: _____

Write down the problem and create a ***hypothesis*** based on what you have researched.

Problem Statement: _____

What to Research: My project is about this topic: _____

Sample topics could be magnetism, electricity, buoyancy, absorbency, plant growth, simple machines, or other scientific topics related to your problem. If you have problems finding out the topic, ask your teacher or an adult for help.

Books I found in the library on my topic are:

Title: **Author:**

_____

_____

_____

Internet sites that I found on my topic are:

_____

_____

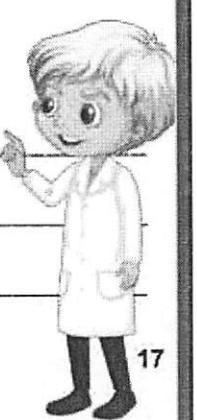
_____

People I talked to about my topic are *(only with parental supervision and approval)*:

_____

_____

_____



Some important points and words that I learned about my topic are:

_____

_____

_____

Next, it is time to PREDICT what you think will happen if you test your problem. This type of "EDUCATED GUESS" or PREDICTION is what real scientists call a **HYPOTHESIS**. So how do you begin? Well, just answer this very simple question: ***What do you think will happen?***

Write your hypothesis in the form of an If.....then.....statement.

Example Problem Statement: When wet, which brand of paper towels can hold the most pennies?

Example Hypothesis:

If Brand X paper towel is wet with 10 mL of water, **then** it will hold more pennies than Brand Y and Brand Z paper towels **because** it is made with a stronger fabric and is double-plied.

If the same Hot Wheels car is sent down 3 tracks, one covered with sand paper, one covered with aluminum foil and one covered with plastic wrap, **then** the car will roll faster down the ramp covered with plastic wrap **because** there will be less friction on the ramp with plastic wrap than the ramps covered with sand paper and aluminum foil.

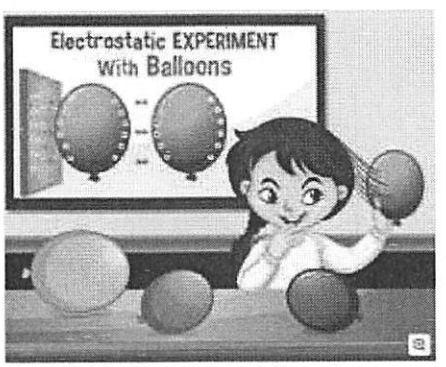
This hypothesis not only predicts what will happen in the experiment but also shows that the "Scientist" used research to back up his prediction.

Hypothesis: If _____ **(cause), then**

_____ **(the**

effect) because _____

(the reason you believe this to be true).



Step 3 – Test your hypothesis by performing your experiment.

First, gather up your **MATERIALS**. What will you need to perform your experiment? Ask an adult to help you get the items you need. Take pictures or draw pictures of your materials.

NOW IT'S YOUR TURN! DUE DATE: _____

MATERIALS:

1)	6)
2)	7)
3)	8)
4)	9.
5)	10.

Second, write your **PROCEDURES.** A procedure is a list of steps that you did to perform an experiment. Make sure to list the steps in numerical order. Start each sentence with an action verb: mix, stir, get, measure, etc. Include quantities, or amounts, that you will measure using metric units. Take pictures of yourself doing the steps ***but do not include your face in any of the pictures.***

PROCEDURES:

1)

2)

3)

4)

5)

6)

7)

8)

Third, identify your **VARIABLES**. The ***independent variable*** is any factor that can change in an experiment. The independent variable is the factor you are testing. The results of the test that you do are called the ***dependent variables***. The dependent variable is what happens as a result of your test. The ***controlled variables*** are the variables that will be the same for each trial. Use a ***control group*** if applicable in your experiment. A control group is a group that does not receive the experimental variable. Both it and the experimental group have what is usually considered normal conditions, i.e., room temperature, normal amount of water, and normal amount of sunlight (constants). A control group helps you ensure that what YOU DO in your experiment affects the test results.

Example Variables using the car and ramp example from the Hypothesis section:
Independent Variables: The independent variables include the ramp coverings of sandpaper, aluminum foil, and plastic wrap.
Dependent Variable: The dependent variable is the time is takes for the Hot Wheels car to roll down the ramps.
Controlled Variables: The controlled variables include ramp height, ramp length, and the Hot Wheels car.
(Control Group: There is no control group for this experiment, so it does not need to be listed.)

VARIABLES:

Independent Variable:	
Dependent Variables:	
Controlled Variables:	
Control Group (if needed):	

Fourth, TEST, TEST, TEST. Follow your procedures step-by-step. Your results should be consistent to be a good experiment. You must perform the experiment ***at least three times*** to test it properly. Do not forget to take pictures of the science project being done and the results.

Fifth, collect your **DATA.** Record the results of the experiment every time you test it. Be sure to organize by using charts, graphs, or other organizers to easily read the results and look for patterns.

DATA TABLE:

Trial 1:	Trial 2:	Trial 3:

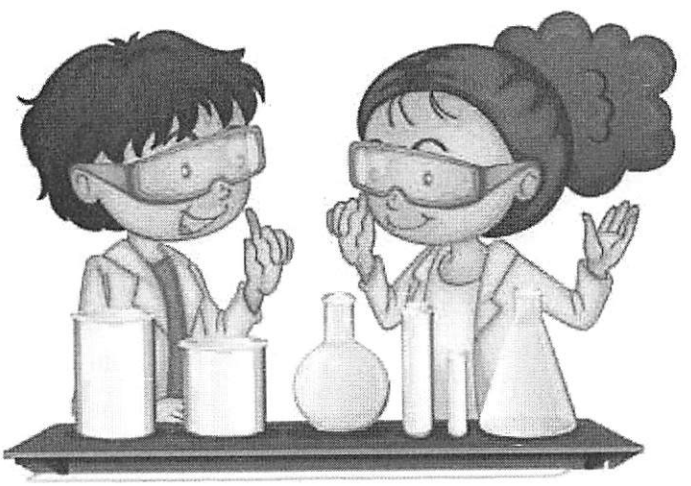
GRAPH DRAWING SPACE:

Step 4 – Draw Conclusions

NOW IT'S YOUR TURN! DUE DATE: _____

Answer the following questions to summarize what you have learned from the experiment to complete the ***Conclusion*** section:

What was the purpose of the investigation?	
Was your hypothesis supported by the data? Indicate evidence and reasoning that supports your conclusion; this is called Conclusion Evidence Reasoning (CER).	
What were the major findings?	
What are the possible reasons for the results?	



Step 5 – Applications

NOW IT'S YOUR TURN! DUE DATE: _____

Answer the following questions to complete the ***Application*** section:

How can you use the findings from this investigation in your day-to-day life?	
How can the investigation be improved?	
What new question(s) has your experiment led you to ask that could be tested in a new investigation?	

Step 6 – Abstract and Bibliography *(Due with online registration & submission packet).*

The **abstract** is a complete summary of the investigation and ***must consist of three to five paragraphs with a total of approximately 250 words*** that includes the following:

- Describe your purpose and hypothesis. Briefly describe your procedure and the materials you used.
- Describe and explain your results and state if your hypothesis was supported or not by the results. Suggest a reason why it was or was not supported.
- Explain your conclusion and application(s).

It is important to cite your sources for a science fair project. Put your **bibliography** of at least 3 different sources on the same page listed in alphabetical order. Please visit the website https://www.grammarly.com/citations for help with APA-style citations. Below are some examples of how to cite books, online videos, and websites:

> **Here is an example for a book or magazine:** Kenney, K. L. (2016). *The Science of Race Cars Studying Force and Motion*. ABDO Publishing.
> **Here is an example of an online video:** [Kids Academy]. (2019, October 31). *Force and Motion for Kids - Ramps* [Video]. YouTube. youtu.be/y6VjHcOX8_o
> **Here is an example of a Website:** Ducksters. (2023). Physics for Kids: Friction. *Ducksters*. Retrieved from https://www.ducksters.com/science/friction.php

Complete the Project Abstract/Bibliography form and submit it to the teacher for final approval *BEFORE* working on the PowerPoint and science fair board.

Elementary Science, Mathematics, Engineering, And Invention Fair

Investigation Project Abstract / Bibliography

Student's Name: _____

Project Title: _____

Abstract

Be sure to include the following information in the abstract of your project:

1. The purpose of the project: Why did you choose to do this project, or how did you get the idea?

2. State briefly your hypothesis (what you thought would happen). Also, describe how you conducted your project (your materials and procedures).

3. What happened? Tell the results of your experiment.

4. What was the conclusion? Was your hypothesis supported?

5. What are the applications of your project? How can others use the information you learned?

6. How could your project be improved if you were to repeat it? If you were to continue your project, what would you do?

Bibliography in APA Format

There should be at least three (3) references. *Please see page 23 for more information and examples.*

Elementary Science, Mathematics, Engineering, And Invention Fair

Investigation Project Abstract / Bibliography

SAMPLE

Student's Name: Jordan Web

Project Title: Wrap It Up!

Abstract

The purpose of this project is to determine if increasing the number of wraps around an electromagnet will increase the magnet's strength. It is hypothesized that increasing the number of wraps around the nail will increase the strength of the electromagnet.

Wire, a nail, a D battery, and a battery holder were the materials used to build an electromagnet. The wire was cut 90 cm long so that 10, 20, and 30 wraps could be wrapped around the nail. An electromagnet with 10 wraps was used to pick up paper clips three times. Then using the same steps, the electromagnet was built using 20 wraps of wire, tested three times, and then tested with 30 wraps. The number of paper clips collected was recorded in a data table for all the trials.

Results showed that in all three trials, the average number of paper clips picked up by the electromagnet increased as the number of wraps increased from 10 wraps to 20 wraps to 30 wraps. The hypothesis was correct.

This experiment shows that the number of wire wraps on an electromagnet affects its strength. In real life, if a stronger electromagnet is needed to separate metal from nonmetal objects, its strength can increase by increasing the number of wraps.

The project may have been improved and had better data if a new battery had been used for each trial.

Bibliography

Brain, M., & Pollette, C. (2021, September 7). *How Electromagnets Work*. HowStuffWorks. Retrieved July 7, 2023, from science.howstuffworks.com/electromagnetic-propulsion.htm

Britannica, T. Editors of Encyclopaedia (2023, March 25). electromagnet. Encyclopedia Britannica. https://www.britannica.com/science/electromagnet

Van Vleet, C. (2022). *Electricity : Circuits, Static, And Electromagnets with Hands-On Science for Kids*. Nomad Press.

Investigation Project Exhibit and Safety Display Guide

- Keep the exhibit neat, uncluttered, and to the point.
- All posters, charts, etc., must be attached to the science fair board.
- No part of an exhibit may be attached to walls or tables.
- The science fair board must be self-supporting (FREE STANDING).
- Be sure to make everything sturdy so it can be safely transported. Fasten/glue everything well.
- The science fair board displays your project. Use attractive lettering and designs.
- Use one-color printing to avoid confusion.
- Spell correctly. Your name and school name should go on the back of the board.
- The main points should be large and simple. Details must be clear and legible from three feet away.
- The **abstract and bibliography** must be placed on the board's lower left-hand corner (as you face the board).

EXHIBIT SPACE: Maximum size is Width: (side to side) 92 cm (36 in) Depth: (front to back) 76 cm (30 in) Height: Table Exhibit 92 cm (36 in)

Elementary Safety Display Guide:

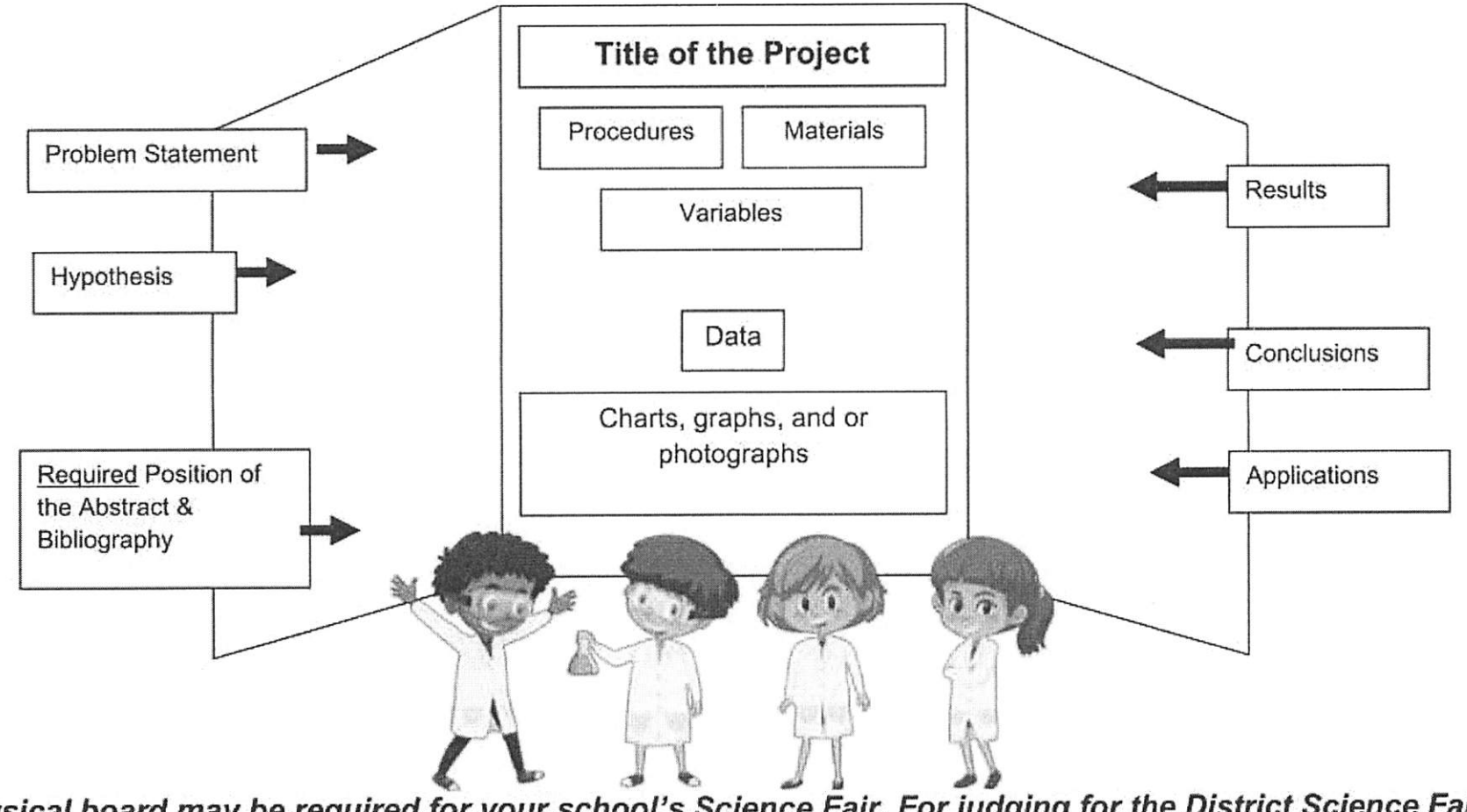
- Anything hazardous to the public, the exhibitor, or other exhibitors is **PROHIBITED**.
- Nothing sharp or pointed should be attached to the board.
- **No** plants may be displayed, (**Reminder: No fungi, mold, algae, or bacteria were allowed to be part of the experiment.**)
- No chemicals of any kind may be displayed. **No** prescription drugs or dangerous and illegal substances were allowed as part of the experiment.
- No flammable substances may be displayed.

An alternative solution to displaying any of the above items ***allowed*** as part of the project is to take photographs of the substances used or use a digital camera and create large pictures with a computer printer for display on your board. ***No people's faces or identifying parts (like the school name on a shirt) may be displayed in photos.***

The classroom teacher or the school's Science Fair Committee will inspect all projects for adherence to Science Fair Safety Rules. Failure to follow these rules will be grounds for disqualification from the school and/or District Science Fair.

Elementary Science, Mathematics, Engineering, and Invention Fair

Board Set-up for an Investigation Project



A physical board may be required for your school's Science Fair. For judging for the District Science Fair, a PowerPoint is required. A physical board is only needed if your project is selected for display.