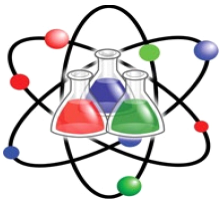
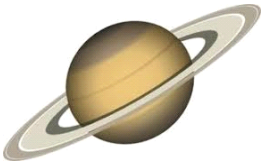




7th Annual

Bay Farm School

Science & Engineering Fair

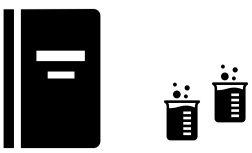
Monday, February 8th, 2021

Information Packet

http://bayfarmptsa.org/students/steam/sciencefair/

Visit the Science Fair web page to:

- Find project ideas, science resources, judging information, and presentation examples.
- Register and submit your completed project!



Sponsored by the Bay Farm School PTSA

Bay Farm Science & Engineering Fair Guidelines

Projects:

- Projects can be done individually or in groups.
- Projects can be in any STEM area (Biological and Life Sciences, Environmental and Earth Sciences, Math and Computer Sciences, Physical Sciences, Engineering, Behavioral and Cognitive Sciences, etc.)
- Projects may be focused on discovery ("how something works" or "why something happens") or on ways to improve a process or design ("how can something be better").
- "Works in Progress" are OK. Don't worry if your experiment isn't totally complete – tell us what you have learned so far!
- It is not necessary to spend a lot of money to have a successful project. You can use common, inexpensive household materials for great projects.
- This year's Science & Engineering Fair will use videos and other visual media to showcase your projects. There are two parts to each entry: a **visual presentation** and an **interview video**.

Visual Presentation:

- You will make a visual presentation using Google Slides, Flipgrid, Prezi, or any other software of your choice. You can also make a physical board presentation like for traditional science fairs, and then take pictures or video of your board, section by section.
- Whatever format you use, make sure you include the sections found in a presentation board. See next page for the differences between science and engineering boards.
- When you have made your presentation, upload it to Google Drive, Vimeo, or YouTube, keeping your settings private or unlisted. Copy the link, which you will share with us on your registration form on the science fair website. Or, if your file is 100 MB or less, you may upload it directly to the registration form.

Interview Videos:

- Students, please ask an adult in your home to interview you about your project. Relax! The judges who will be viewing these videos are friendly. 😊
- If the project was done by a group, everyone in the group should be present to answer these questions, and everyone should get a chance to talk. If you and your group members are in different households, you can record yourselves doing the interview over Zoom.
- Practice your answers before the interview so you are comfortable talking about your project.
- Answer all 5 questions. Your answers do not need to be long, but they should be well thought-out. (The interview video should be 4-10 minutes in length).
- When you have recorded your interview, upload it to Google Drive, Vimeo, or YouTube, keeping your settings private or unlisted. Copy the link, which you will share with us on your registration form on the science fair website. Or, if your file is 100 MB or less, you may upload it directly to the registration form.

Interview questions

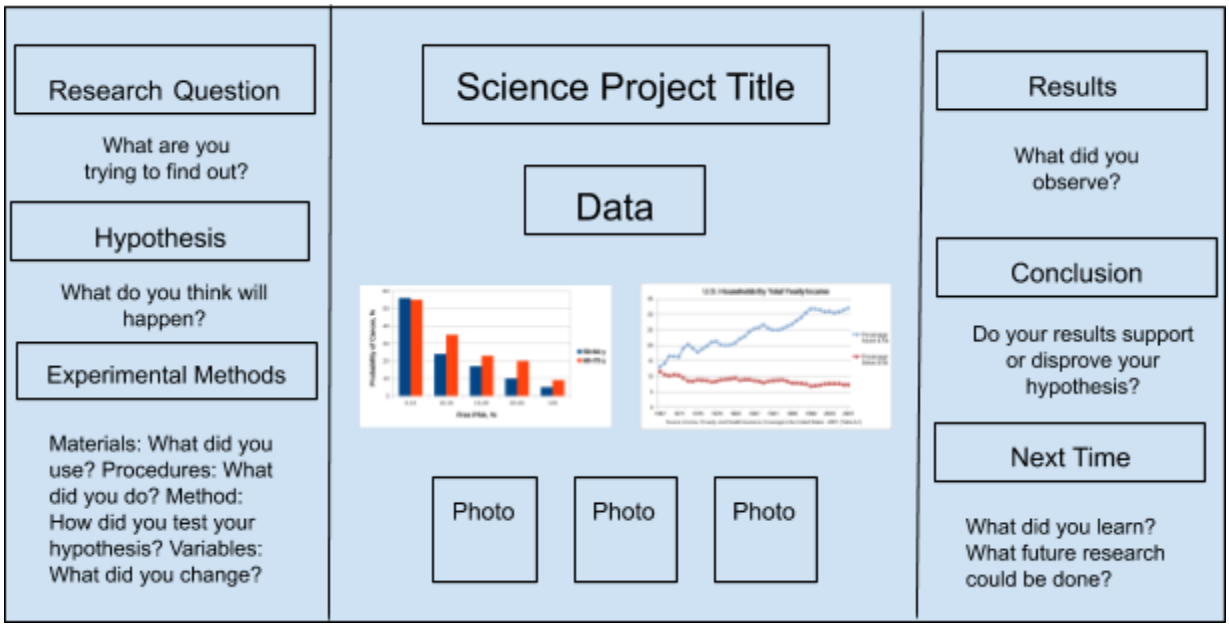
1. Please describe your project. How did you come up with this idea?
2. How did you decide what to use for your materials and methods?
3. Can you tell me about your results? Did anything confuse or surprise you about them?

4. What did you learn about your research question, and why did you conclude this?
5. If you were to do a similar project again, what would you do differently? You can talk about problems you would fix, or different materials or procedures you would use.

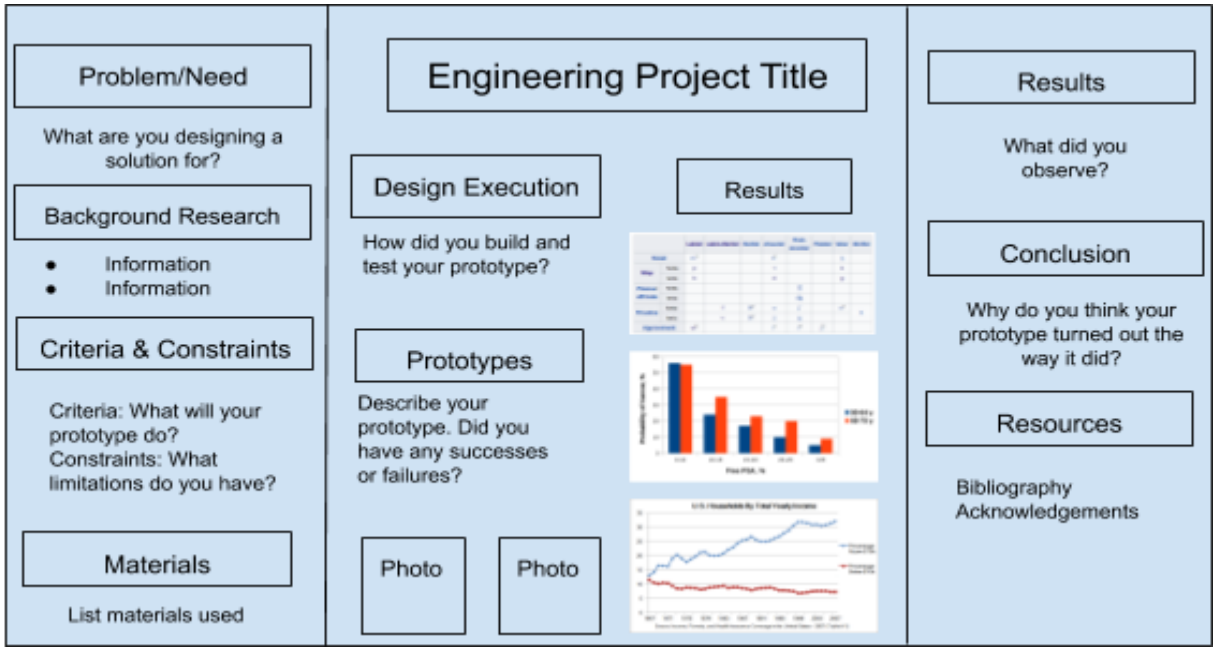
Display Boards & Exhibits:

- If you choose to make a physical board, keep it neat and easy to follow.
- Exhibits are placed in front of your board and can include your science journal, equipment you used in your experiment, samples, etc. Do not include live animals, dangerous chemicals, explosives, drugs, hypodermic syringes or needles, or open flames.

Here's an example display board for a science experiment:



Here's an example of a display board for an engineering project:



What you need to do to enter the Science and Engineering Fair: An Overview

1. **Select a Project/Topic:** A science fair project is an experiment you perform or observations you make to find an answer to a question - "how something works" or "why something happens". Choose a topic that you are interested in.
2. **Gather Background Information & Research:** You can get information about the subject of your science fair project from books, magazines, the Internet, people, libraries and companies. Keep notes about what you've learned (a journal is great) and where you've gotten the information, and use them in your presentation.
3. **State your Research Question:** What is the question you are going to try to answer in your experiment or project? Use the scientific method or engineering design process to answer that question.
4. **Make a Hypothesis:** Based on the background reading that you've done, make an educated guess about what you think will happen in your experiment or project.
5. **Conduct Your Study:** Do your experiment or build your engineering prototype. Remember to record your observations, measurements, and results, and include them in your presentation!
6. **Analyze Your Results:** Describe what happened in your experiment or engineering project. It's great if you can make tables, graphs, or charts to summarize the results of your measurements or observations.
7. **Summarize and Make Conclusions:** Do your results support or disprove your hypothesis? It is alright if your results disprove your hypothesis – this happens all the time in science. Make sure you state your conclusions in your presentation!
8. **Make a Visual Presentation:** Create a presentation using Google Slides, Prezi, Flipgrid, or other software, or construct a physical board and take pictures or a video of it. It should be neat and easy to see (does NOT have to be typed). Show what you did, how you did it, and what your results were. Use the section labels in the example boards to keep it organized. Draw, decorate, and make it fun!
9. **Record your Interview Video:** Ask an adult in your home to ask you the 5 interview questions about your project. Relax, think about your project, and just talk naturally!
10. **Register and Submit your Project:** Upload your two files (your visual presentation and your interview video) to your Google Drive, Vimeo, or YouTube. Then go to http://bayfarmptsa.org/students/steam/sciencefair/ and enter your information, along with the links to your files, to register and submit your project. Congratulations! You did it!
11. **"Visit" the Science & Engineering Fair:** We will be creating a way to share all the entries so you can see what other students did in their scientific explorations.
12. **Keep an eye out for Results and Awards:** We'll be sending an announcement. Find out how you did and cheer on other students and teams who entered the fair!

There are 3 main types of projects you can enter in the Science & Engineering Fair. Here you can read an example of each.

Science Project Example

- Define a testable question.
    - What is the effect of a change in the amount of sunlight on the growth of tomato plants?
- State your hypothesis.
    - I think the plant that gets the greatest amount of sunlight will grow the tallest, and decreases in sunlight will result in decreases in growth.
- Identify a control (a "standard" group) and test group to compare against.
    - I will put one tomato plant (the control) in a sunny window.
    - I will put 5 tomato plants (the test group) in the same window and leave them there for different lengths of time.
    - I will record how many hours of sunlight each receives and their growth every day.
- Describe how you will run the experiment.
    - I will put the control plant and the 5 test group plants (labeled test #1-5) in a sunny window. I will remove one tomato plant (test #1) after 2 hours of sun; remove a second tomato plant (test #2) after 4 hours of sun; remove a third tomato plant (test #3) after 6 hours of sun; remove a fourth tomato plant (test #4) after 8 hours of sun; and remove a fifth tomato plant (test #5) after 10 hours of sun. I will put the test plants back in the window at the same time each day and repeat for several weeks, and record how much they grow each day.
    - I will leave the control plant in the window and record how many hours of sunlight it received and how much it grew each day.
- Define your variable. Make sure that you only change one variable at a time.
    - The variable in the tomato plant experiment is the number of hours each test plant stays in the window each day.
- Describe what you are measuring (what is changing). These are the quantitative measurements you take during the experiment.
    - I will measure the amount of growth observed in each tomato plant (both the control and the test group). I will measure the plant growth in cm/day.
- If possible, repeat your test to see if your results are reproducible.
- Analyze your data and draw conclusions. It is good to put your data in graphs/tables.
    - I will compare the difference in plant growth between each test plant and the control plant.

Engineering Project Example

- Clearly define the problem or need the engineering project will solve.
    - For example, I would like to build a solar-powered desk fan to keep me cool while I study.
- Establish criteria and design constraints. Criteria are physical and functional characteristics of the design (the shape, weight, function, etc.) Design constraints are things that limit the project; such as time you have to spend on the project, the project's budget, and the availability of materials needed.
    - In our example, the criteria could be:
        - small enough to fit in the right-hand corner of my desk (15cm x15cm x 15cm)
        - powered entirely by the sunlight coming into my window
        - keeps me cool while I am in online classes

    - Design constraints and limitations could be:
        - the budget I have to buy materials I need, like a solar panel and soldering iron.
        - finishing the project by the end of January (so I have enough time to put together the presentation for the February 8th, Bay Farm Science & Engineering fair)
        - the materials available, like a broken fan to use for parts.
- Research and evaluate alternatives to develop a plan
    - In our example, you might:
        - find out how much electricity a conventional, batter-powered fan of similar size uses.
        - identify solar-panels that can supply a similar voltage
        - compare the available options to determine which best meet the project criteria.
- Construct a prototype or computer model to test your design.
    - This is when you start building your solar-powered fan!
- Test and refine your prototype and settle on a final product.
    - Test your solar-powered fan against your established criteria. Does my fan fit in the space I have on my desk (a 15cm x 15cm square)? Does it run using the solar-energy available through my window? Does it move a sufficient volume of air to keep me cool while I take my online classes?
- Failure analysis, tweak and re-test as many times as possible.
    - Keep a journal to record what you do: how you fix problems, what you change, and what works/doesn't work.

Product Testing and Design Project Example (Follows the scientific method)

- Clearly identify what kind of product (candles, hair products, etc.) you plan to test.
    - In this example, I will test commercial and natural laundry stain removers to determine if there is a difference in efficacy.
- Define a test group of similar items.
    - I will compare Shout™, Seventh Generation™, vinegar, and baking soda.
- Define the experimental procedure.
    - I will make tomato sauce stains on five white t-shirts. I will treat four of the stained t-shirts with the different stain-removers in my test group. The last stained t-shirt will not be treated (the control). I will then run the white t-shirts through a normal laundry cycle (wash & dry). I will compare the stains remaining, if any, on the five shirts.
- Describe how you will take measurements.
    - I will look at the t-shirts to determine how clean they are. I will use a color wheel to compare the stain intensity.
- Define criteria for changing qualitative measurements into quantitative measurements.
    - I will make a graduated scale from 1-10 where increasing numbers indicate increasing levels of cleanness. For instance, 1 = stain before any stain treatment, 3 = dark stain, 5 = lighter stain, 7 = very light stain, and 10 = perfectly white. I will use a color wheel to differentiate the stain intensity.
- Analyze and draw conclusions from your test measurements and observations. It is a good practice to put your data in graphs or charts.
    - Based on the stain intensity, I can conclude which stain-remover in my test group is most effective in removing tomato stains from white t-shirts.

Conducting Behavioral, Cognitive, and Psychological Science Projects

Did you know that you can do a science project on the human experience as well? You can ask questions about people's motivations, behaviors, feelings and moods, as well as questions about memory, thinking, and perceptions. For example:

- What effects does sugar have on concentration and memory?
- What motivates kids to do good deeds like helping others?
- How does exercise affect people's moods?
- How does a certain book/movie affect the way people think about a certain issue or group of people?
- Does making art affect how kids feel about themselves or others?

In all of these examples, you will need to think about how to define your variables (e.g., exercise = 20 jumping jacks, or making art = 20 minutes of painting) and how you will measure your results (e.g., memory = how many random words can they memorize, or moods = rate your happiness on a 5-point scale).

During distanced learning, classroom projects may not be possible. However, in case you have a large household or are part of a social bubble, you might ask them to participate using the same basic guidelines as outlined below for classrooms:

If you would like to have your classmates participate in your experiment, you will need to ask permission from your teacher. You should describe what you want to do, when you want to do it, and how long it will take. Also, please keep these guidelines in mind:

- Participation must be voluntary, meaning nobody has to participate if they don't want to.
- Everyone in class should be invited to participate (i.e. no discrimination).
- There should be minimal risk of harm (in other words, no one should get sick, hurt, or have hurt feelings or be upset by participating in your experiment).

Have fun and be creative!

More tips and science fair project ideas can be found here: http://bayfarmptsa.org/students/steam/sciencefair/