PS11 Science Fair

Frequently Asked Questions

Is the Science Fair for you?

The Science Fair is ideal for someone who is curious about math, social studies, science, arts, reading, history, writing and more. It explores and combines all of these in one creative and collaborative project. Science Fair candidates learn and apply the scientific method, practice working with friends and learn how to communicate ideas better.

What is a Science Fair project?

A Science Fair project is an experiment that answers a question about the world around us. An *experiment* is what scientists do to test their ideas about how things work. Thus, every project must start with a question you are trying to ask and a hypothesis (an idea/answer to the question) that will be tested by doing the experiment. Doing the experiment is the fun part. So let's get started

How should I get started?

- **List a few general topics that interest you. Look for something about that topic that you wonder about and want to understand better.** ***Explore!*** Inspiration can come from hobbies, magazines, newspaper articles, books, science-based websites and the library! Choose your favorite area of interest and ask your teachers, classmates and parents what they think.
- After you narrow down the topic, think about **how you might design an experimental project that asks and answers a question.** What is your question? Make it simple and specific.
- **Research** background information about your topic and find out if anyone asked this question before. What did they find? How did they find out? Record your information sources in a detailed **bibliography** (see below for description of a bibliography).
- Based on your research**, make a hypothesis.**

What is a hypothesis?

A **hypothesis** is an **idea** you have about the **answer to your question.** The fun part is testing your idea by doing an experiment to see if you are right. Your hypothesis should do two things. It should **predict the answer** to your question and provide a specific explanation of **WHY** you think your hypothesis is true (based on your research)**.**

Sample question: Does size of airplane wings affect how far a paper airplane will fly?
Sample hypothesis: The larger the area/size of the airplane wings, the farther a paper airplane will fly *because* air pushing up on wings provides the force to lift an aircraft.

What is a variable?

In science, a variable is any part of the experiment that can be controlled or changed.

How do I design an experiment?

A controlled **experiment** is how scientists test a hypothesis to figure out if it is true or not. In the example above, the idea being tested is whether or not wing size affects how far a paper airplane will fly. So you will design an experiment that tries to show a connection between wing size and flight distance.

A good controlled experiment will test the effect of changing one and *only one* thing, and then observe or measure the outcome of that change on the phenomenon we're studying. The condition or thing that is being changed is called the **independent variable**. Here, the independent variable is the airplane's wing size. You are trying to find out is how far the airplane will fly. How far the airplane flies is called the **dependent variable** because it depends on the wing size (the independent variable). In each trial, the independent variable stays the same, but the dependent variable most likely will change. Then you will try the next wing size, and see what happens. Ideally, only one variable condition at a time is being changed in the experiment. You control all the other variable conditions so that they remain as identical as possible. The only thing you are changing in this experiment is the wing size of the paper airplane (the independent variable). This is how you can best ensure that any effects or results are caused by changes in just your independent variable (the wing size) and not some other reason. For example, if you made a completely different kind of paper airplane, or made it out of a different kind of paper, you wouldn't know which variable caused the result.

You would fold several airplanes with carefully measured wing sizes, fold them under identical conditions (*see below) and measure exactly where the airplane touched down. You would repeat for each plane at least three times and average the results. Then, you would note any consistent relationship between wing size and flight distance. The best kind of data can be measured, counted, and put into numbers so that observations can be easily computed, compared and analyzed.

*Good science involves repeating an experiment to make sure you get similar, reliable and believable results. Since one can't always throw a paper airplane exactly the same way in exactly the same conditions, it is very important to repeat the experiment multiple times and then combine or average the results.

Some of the best Science Fair projects are designed from scratch by students about things observed in daily life. However, the project must be **doable**! This is where looking at a good Science Fair website (see the Science Fair Packet for a list of websites) can help you come up with project ideas and how to do them, provided they comply with the above requirements.

Finally, remember, safety first. Make sure your experiment doesn't involve materials or activities that could be dangerous to you or others.

How do I measure a variable?

Use the **metric system**! Make sure you have clearly understood and identified the independent and dependent variables in your experiment. You must carefully measure the independent variable because that it what you are testing. The more accurate you are, the better the experiment, and the more you will learn. Scientists measure everything! We measure size, mass, temperature, density, volume, and more. And we **ALWAYS** use the metric system.

How do I start my experiment?

1. Create a materials list.
2. Gather your materials before you start your experiment.
3. Create a step-by-step procedures list.
4. Once you have identified the variables you will change, start the experiment.
5. Repeat the process. The more repetitions you have the more robust your experiment!
6. Record your results.
7. Analyze your results and write your conclusion.

While you are conducting your experiment, think:

- ✓ Do your results support your hypothesis?
- ✓ Did you properly control for the variables?
- ✓ Do you need to collect more data?
- ✓ What were the limitations of your experiment?
- ✓ How might you improve your experimental design in future studies?

How many times do I have to repeat my experiment to support my hypothesis?

You are not repeating your experiment to try to get the "right" answer. You are repeating it to find out if your hypothesis is really correct. If you get results that surprise you, then you **really** need to repeat the experiment to make sure! Don't stop your experiment if after just a few trials you derive the same results that seem to support your hypothesis. Repeat your experiment multiple times and see if your data **still** support your hypothesis. Think like a scientist! All data is good data, because it provides information. **Never exclude data that doesn't support your hypothesis.** Think about *why* the data doesn't support your hypothesis and make sure you include this in your **analysis** *and* **conclusion.**

What are the stages/schedule of the Science Fair process?

The various stages are listed in detail in the Science Fair Packet (posted on the Science Fair website). Science Fair groups are typically made up of two to four students with no students working alone. The length is approximately two - three months. Depending on the topic, groups may meet once a week for 10 weeks or bi-weekly until project completion. It's important that you **plan ahead** (for e.g., consider vacation days and coordinate with your team members accordingly). **Pace** your work. Don't start the experiment two weeks before your report is due!

Can students from different grades form a team?

No, students from different grades **may not** form a team. However, students from different classrooms may form a team.

What is a bibliography and why is it important?

For your Science Fair project, a bibliography is a list of the books, website, magazine articles, interviews you have used in order to carry the science experiment.

A bibliography is important because it tells your teacher what you have read on your subject, what sources you have used to gather information. It also demonstrates your recognition of other intellectual contributions made on the topic. *Never* take credit for other people's work; that's plagiarism!

What do the judges look for when they review our reports?

There are several items that must be included in the report. The list of items is found in the section of a sample report in the Science Packet. The judges look for clarity of thought, presentation and for evidence that the scientific method was followed. I.e., is there a testable question, and a specific hypothesis that can be investigated? Is there evidence that the data collected was actually measurable and how accurately was it measured? Were there several trials from which to collect data? The judges will also look at the depth of the conclusions and the scientists' ideas and theories that explain the results. In the report there should be charts, graphs, data tables, pictures, and anything else that would help make the presentation clear. Don't leave anything out. All data is good data, because it provides information. *Never* exclude data that doesn't support your hypothesis. Think about *why* the data doesn't support your hypothesis and make sure you include this in your **analysis** *and* **conclusion.**

Your display poster board should reflect what is already in the written report.

Mr. Roylance will return your report with feedback to one of your team members. Please coordinate among each other to review how you did.

What do the judges look for when my team and I make our presentation?

- ✓ Does your project ask a specific scientific question?
- ✓ Do your results support or not support your hypothesis? If the latter, how does this change your thinking? What did you learn?
- ✓ Did you properly control independent variable(s) ("experimental variable"), repeat experiment and analyze data?
- ✓ What were the limitations and/or alternative explanations for results of your experiment?
- ✓ How might you improve your experimental design in future studies?

Plan ahead and rehearse your speech with your teammates. Each student will be judged, in part, on his/her comfort expertise and fluency on the topic.

Can I make a machine, robot or write a computer program as a Science Fair project?

Students can build a "thing" for their science project, but it MUST still be used to ask a scientific question and test a hypothesis. One can make a machine or robot but it **must** be for a **purpose**, and one that can be **tested**. For

example, a machine could be built that climbs. The investigation's purpose might be how one can build a machine that can climb steeper inclines than an already existing machine that already climbs steep inclines. *The testable question*(s) might be what variables would affect how well the machine can climb steeper inclines, and the hypothesis would be what the scientists think the result will be.

Note, these projects are incredibly difficult and time consuming and if you pursue this path (1) you must (as always) get prior approval from your teacher and (2) you must plan your time accordingly and efficiently.

Do I get a grade?

Only the 5th grade students will receive a grade on their required Science Fair projects. They will be eligible for prizes at the Science Fair. Their grade will affect their overall science grade.

Third and 4th grade students are encouraged to participate voluntarily in the (competition-free) Science Fair presentation event. They will not be graded.

How is the 5th Grade Science Fair different from 3rd & 4th Grade Science Fair?

It's mandatory and will be part of the 5th grade science grade. Majority of the work will be done at school, but expect to do some work at home with your teammates.

Where do the names go on the poster board?

Names of the scientists should be on the front display AND on the back of the display board so that it can be easily identified when the display board is folded.

Does the written report/poster have to be typed?

You may handwrite your report/poster so long as it is legible.