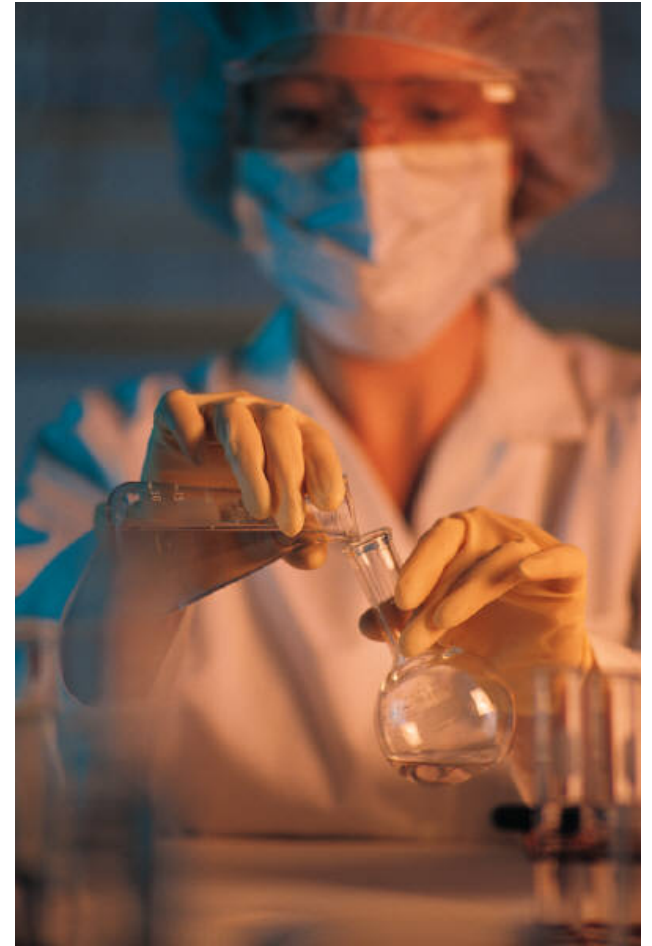


Doing A Meaningful Scientific Discovery STEM Fair Project



The main purpose of science is to discover something or to find out why something happens and connect it to our world to understand our world better to solve problems.



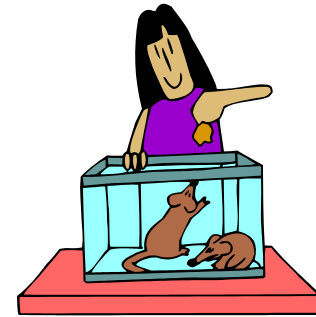
The Scientific Discovery Process

These are the required steps when doing a project using the Scientific Discovery Process.

- Purpose
- Research
- Hypothesis
- Designed Plan and Data Gathering Methodology:
 - Write down the materials you will need
 - Write the step-by-step instructions you will follow
 - Write the variables of the experiment
 - Write the data gathering plan you are using
- Execution: Data Collection and Analysis
- Interpretation

The Scientific Discovery Projects

- The Scientific Discovery Process will be used for the following projects:
 - Earth & Environmental Science Projects
 - Life Science Projects
 - Physics, Astronomy, & Mathematics Projects
 - Chemistry Projects
 - Product Testing and Consumer Science Projects



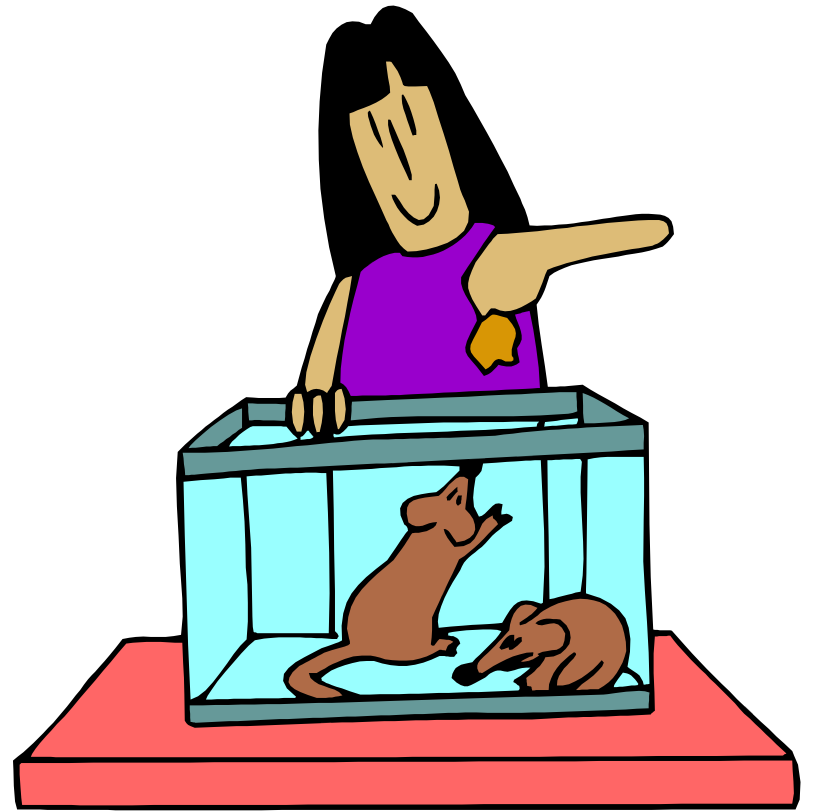
Earth & Environmental Projects

Volcanoes, soil, rocks, minerals, crystals, erosion, weathering, soil deposits, ocean water, earthquakes, fossils, water cycle, weather, air, water, wind, humidity, cold, heat, smog, particles in the water and air, global temperatures, landfills, recycling, composting, any types of pollutants, plant diseases, growing plants organically, and wasting water.



Life Science Projects

Animal, plant, insect, and human behavior; ecosystems such as forests, deserts, grasslands, and wetlands; food chains, plant cycle, and metamorphosis.



Physics, Astronomy, and Mathematics Projects

Forces in nature — gravity, magnets, centripetal and centrifugal forces, friction, balanced and unbalanced forces; laws of motion; work; simple machines; forces in gases and liquids; pressure, buoyancy, and lift; energy — heat, light, sound, electricity; rotation, revolution, seasons, tides, gravitation pull, brightness/color of stars, space particles, stars, micrometeorites, and asteroids; proof through math, geometric studies, distances in space, math formulas and calculations to prove ideas.



Chemistry Projects

States of Matter--
solids, liquids, and
gases; mixtures,
solutions and
suspensions;
chemical formulas,
reactions, and
equations; chemical
and physical changes.



Consumer Science and Product Testing Projects

- Testing products you see in advertisements.
- Testing products against each other to see which is the best such as popcorn, diapers, cereals, gum, soda pop, oil in potato chips or French fries, stain removers, soaps, paper towels, and bandages.



Other Things

That are Required When doing a Scientific Discovery Project

- You need to have a STEM fair journal that shows the work you did and your results following the Scientific Discovery Process.
- You need a display board that shows all the steps of the Scientific Discovery Process.
- An interview will be conducted to see if you can explain the your method of reasoning of the Scientific Discovery Project in reference to the project.

How to prepare the journal, display board and for the interview will be shown later in this document.

Examples of Projects

“What can you do with....?”

eggs

water

flashlights

balls

straws

concentration

shoes

tastes

balloons

rubber bands

memory

newspaper

magnets

salt

colored paper

things that float

smells

different ages

ice cubes

blindfolding

bubbles

sponges

things that sink

music

coins

soaps

noise

marbles

voices

colors

evaporation

cotton

paper airplanes

dissolving things

animal tricks

small cars

Follow the Scientific Discover Process While Doing Your STEM Fair Project

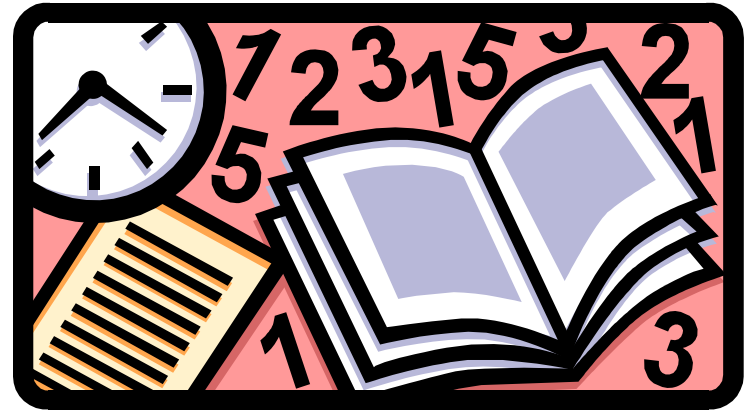
- On the next few slides are the steps of the Scientific Discovery Process.
- Please follow each step of the Scientific Discovery Process as completely as you can.
- Be sure to do each step. Do not skip any steps.
- Write everything you do in your journal.



The STEM Fair Journal

Before you begin you need a journal.

- STEM fair projects need to show a record of everything done by you as a “scientist”.
- This record is kept in a journal, recording all the things you do each day you work on your project.
- You need a title page and a table of contents in the journal.
- The table of contents will include all the steps of the Scientific Discovery Process.
- Be sure you date each day you work on your project.
- All measurements need to be recorded too.



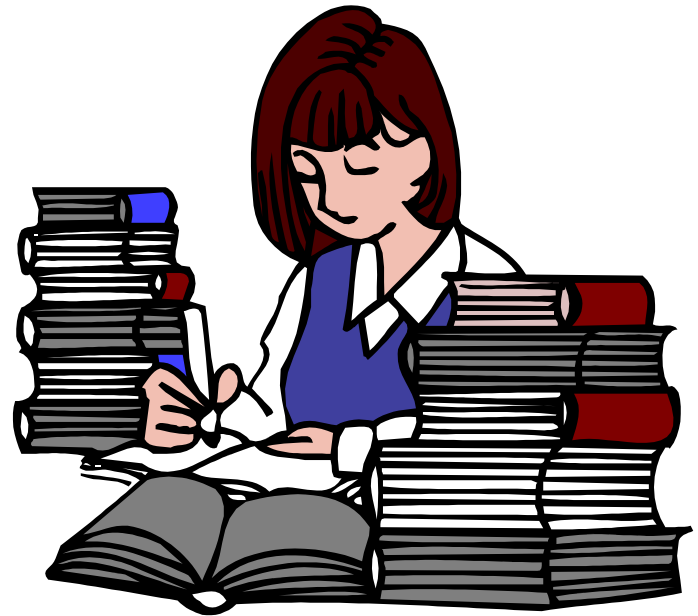
What is Your Purpose?

- The purpose shows that you are going to solve a problem or find out something you don't know. **Write your purpose in the form of a question or statement in your journal.** This is what you want to investigate.



Research Your Topic

- Before you begin experimenting, you some background information by using some of these resources:
 - Encyclopedias
 - Science Magazines
 - Science Textbooks
 - Library Books
 - Internet
 - Interviews
 - Letters
 - Phone Calls
- You need to research your topic by using at least three resources.
- Record the information you learned about in your journal.



Make a Hypothesis

- You are ready to make a prediction of what you think the results of your experiment will be in your journal.
- Based on your research, what do you think will happen when you do your experiment?
- **You also need to put an explanation in your journal as to “why” you chose this hypothesis.**
- **Example:**

Hypothesis:

When light shines on an object, the object will become hotter at a direct angle than on an indirect angle.

Explanation:

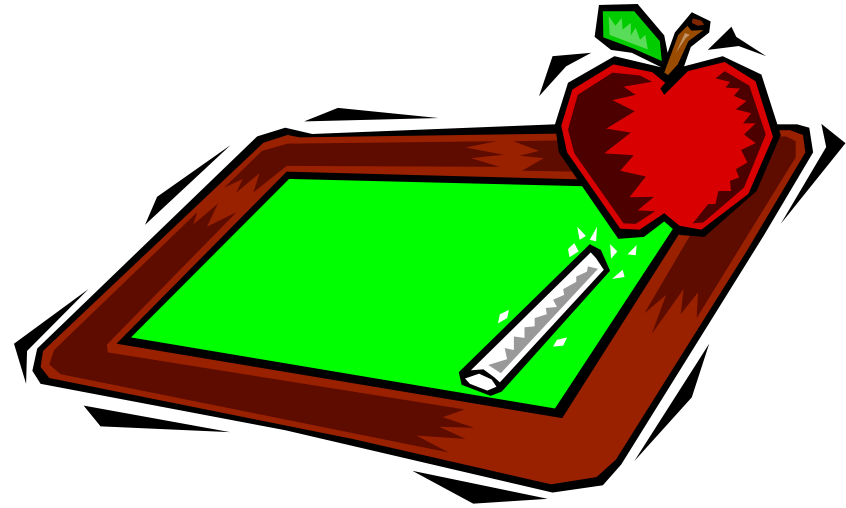
Light shining straight down covers a smaller area than shining on an angle. When on an angle, more heat is spread out causing less heat on the object.



Designed Plan and Data Gathering Methodology

“List of Materials”

- At this time you need to make a list in your journal of materials you are going to need for your experiment.
- Be sure to make your list very complete with describing words.
- Tell of all measurements and quantities you are going to use.



Designed Plan and Data Gathering Methodology

“Step-by-Step Directions”

- You need to write the directions of the procedure you are going to follow to do the experiment in your journal.
- These directions tell exactly the process you are going to follow as you do your experiment.
- As you write your directions in your journal, you have to be sure your test is fair. Keep all the conditions the same each time you do the experiment.



Designed Plan and Data Gathering Methodology

“Controlled and Experimental Variables”

- “**Variable**” means something can change. Everything around us has the possibility of changing so we live among variables. Variables are all the factors that have an effect on your experiment.
- You want to control most of the variables so they are called **the controlled variables**.
- You only want to change one variable to have a different outcome each time you do your experiment. This is called the **experimental variable**.
- Write your **controlled** and **experimental** variables in your journal.



Designed Plan and Data Gathering Methodology

“Data Gathering Plan”

- Before you begin your experiment, you need to write in detail your Data Gathering Plan.
 - Be sure it is:
 - Well designed
 - Well organized
 - And Systematic



The Execution:

Data Collection and Analysis

“Data Collection Plan”

- Be sure to write down the data you are observing in your journal.
- Be sure to collect sufficient data to make a reasonable conclusion.
- Organize your raw data into a chart or table in your journal.
- Test your experiment at least twice so it is valid.



The Execution:

Data Collection and Analysis

“The Graph”

- Make a graph of your data.
- Be sure it is accurately made with all the parts labeled.
- Be sure the graph shows appropriate mathematical and statistical methods.
- Be sure the graph shows strong data comparisons
- Be sure the graph shows the reproducibility of the results.



The Execution:

Data Collection and Analysis

“The Analysis”

To analyze mean to break something up into parts to be able to examine it. That is what you have to do with the data on the graph.

- Write an explanation describing what the graph is telling you and the comparisons you see.**
- Be sure the explanation is accurate and makes sense.**

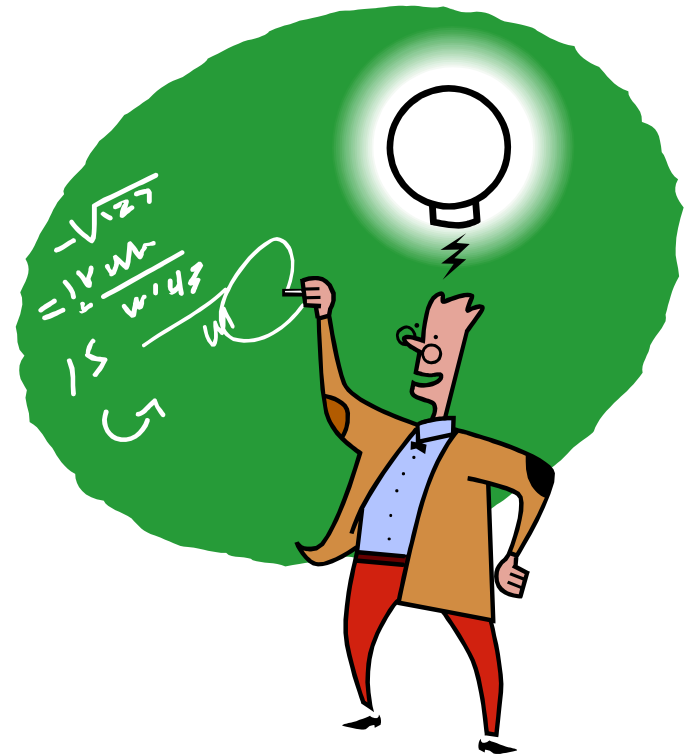


The Interpretation

“What Did You Find Out?”

Write about these ideas in your journal and anything else you can think of.

- Write what you found out.
- Write what you what you learned from your investigation.
- Write other questions you might have now.
- Write what you might do differently next time.
- Tell general statements how this relates to the world.
- Write what connection your results shows with a real world application which shows a transfer of knowledge.
- Does what you wrote show evidences of learning?



The Display Board

This is your Showcase!

You need a display board.

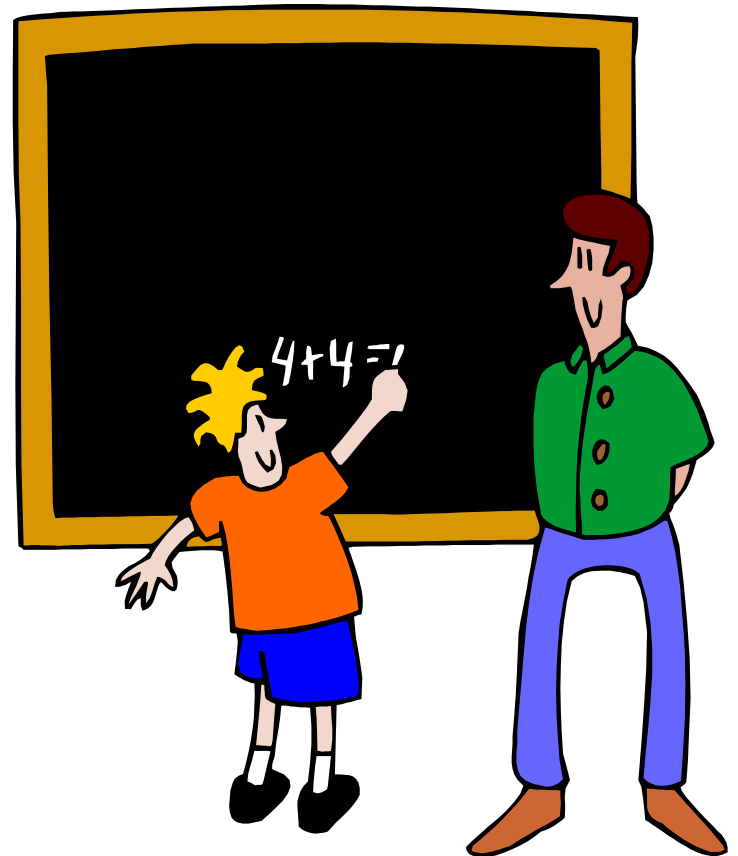
- All the steps with explanation of the Scientific Discovery Process should be on the display board: **Purpose, Research, Design Plan, Data Collection and Analysis, and Interpretation.**
- Research need not be on the board, but your reference cites needs to be on the board.
- Give yourself at least 1 week to make your display board.
- Make it:
 Neat, Creative, Easy to Follow, Errorless (no scribbles), and Informative
- Your display board should reflect your journal.



The Interview

You will be interviewed.

- Know these things:
 - Information you have read about.
 - All the things you did while following the scientific discovery process.
 - What you learned from your project.
 - How the projects has helped you better understanding the world around you.
 - Other questions you now have.
 - What you would change next time if you did the project again.



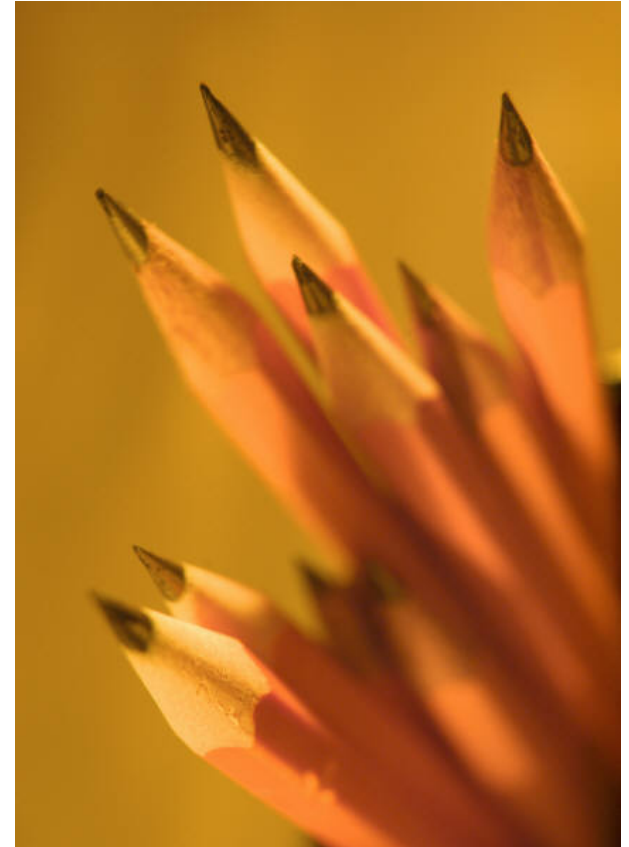
Thoroughness

- Follow through with these ideas:
 - Goals of the project
 - Creativity in the design
 - Clarity
 - Appropriate methods
 - Appropriate equipment
 - Appropriate grade level
 - Knowledge
 - Enthusiasm
 - Individual effort
 - Completed journal
 - Creative display board



2019-20 STEM Fair Entry Form

- Before you begin your project for the school STEM fair, you need to fill out the 2019-20 Central Utah STEM Fair Entry Form.
- Filling out this form helps you know what you need to do to qualify for the school fair, district fair, and the Central Utah STEM Fair.
- It gets you started in the right direction.
- There are three pages to this form that needs to be filled out.
 - Page 1 Student Information and “Special Projects’ Signature Page”
 - Page 2 Science Fair Project Research Plan
 - Page 3 Safety Rules and Signatures



STEM Fair Rules

Some STEM fair projects may be dangerous to humans and animals. If your project includes any of the things written below, signatures must be obtained by professionals to make sure it is safe. These rules are set by the International Science Fair committee and need to be followed when doing a STEM fair project. **If these rules are not followed, the project will be disqualified for any science fair competition.**

1. Using Humans
2. Using Vertebrate Animals
3. Using Hazardous Substances or Devices
4. Using Bacteria, Mold, Fungi, Viruses, Parasites, Human or Animal Fresh Tissues, or Body Fluids
5. Using controlled substances

The following slides go into detail of the projects listed above and the signatures that need to be obtained to qualify to be in the school and district STEM fairs. Page one on the CUSF STEM Fair Entry Form is for the signatures needed.

Also note: Growing any microorganisms must be done in a lab. Any microorganisms that are grown at home will disqualify the science fair project for any competition.

Some STEM Fair Projects Need Signatures

If you do a science fair project **using humans you need approval and signatures from:**

- **Your school science teacher**
- **A school psychologist (from your school), psychiatrist, a medical doctor, physician's assistant, or a registered nurse.**

Note: All people used in the experiment must sign a consent form. If children are used who are under 18, parents must sign a consent form for each of the children used.

Some STEM Fair Projects Need Signatures

If you do a science fair project **using vertebrate animals** you need approval and signatures from:

- Your school science teacher
- A biomedical/biological scientist (veterinarian in this case)

Note:

- Pets can only be used for these experiments and used for observational purposes only for behavioral study.
- There can be no pain or discomfort to the animal(s) during the experiment.
- Proper care must be provided at all times.

Some STEM Fair Projects Need Signatures

If you do a science fair project using **controlled substances** (prescription drugs, tobacco, alcohol) you need approval and signatures from:

- Your school science teacher
- A biomedical/biological scientist

Note:

- An adult must directly supervise the experiments.
- Students must adhere to all federal, state and local laws when acquiring and handling controlled substances.

Some STEM Fair Projects Need Signatures

If you do a science fair project using **hazardous substances or devices (chemicals, firearms, welders, lasers, radioactive substances, radiation)** you need approval and signatures from:

- Your school science teacher
- A school administrator from your school

Note:

- An adult must directly supervise the experiments.
- Adhere to federal and state regulations governing hazardous substances or devices.
- Follow proper safety procedures for each chemical or device used in the research.

Some STEM Fair Projects Need Signatures

If you do a science fair project using **bacteria, mold, fungi, viruses, parasites, human or animal fresh tissues, or body fluids** you need approval and signatures from:

- Your school science teacher
- A biomedical/biological scientist

Note:

- Elementary students cannot use blood in experiments.
- Organisms collected in petri dishes must be sealed, grown and stored only in a controlled place like a science lab under the supervision of a scientist. They cannot be grown and stored at home. They will be disqualified if they are grown and stored at home.
- Using plant parts, hair, sterilized teeth, and fossilized tissue in experiments need no signatures.

Using People in Your Experiment

If you use people in your project, you must get proper signatures to use them.

- If they are 18 and over, you need to have them sign a paper saying that it is all right to use them in an experiment.
- If they are under 18, you need to have the parents of these children sign a paper saying that it is all right to use them in an experiment.



For More Information and Help on Putting a STEM Fair Project Together...

You can visit the
Central Utah STEM
Fair Website at:

<http://cusef.byu.edu>



Questions or Puzzled?

If you have any questions about the rules or procedures, contact

paul.nance@jordandistrict.org or call at 801-244-6479.

