Parley's Park
Science and Engineering Fair Packet for 5th Grade

The Park City School District is pleased to invite all students within the district to participate in this year's SCIENCE AND ENGINEERING FAIR! Students gain the opportunity to create their own personalized investigations that go beyond the classroom. It is our hope that in offering this opportunity students will foster an appreciation for science and engineering.

What is a Science or Engineering Fair Project? A science fair project is a presentation of an experiment that answers a specific testable question. Finding an idea for an engineering project requires you to identify the needs of yourself, another person, or a group of people. Your project then needs to demonstrate how you have solved the problem for that need. Science and Engineering fairs show the efforts of a student's investigation and provides a way for the student to "show-off" what they have learned. Whatever the project, find something you as a student are interested in and would like to learn more about. You will need to be able to explain your project to our judges, so it should be an age appropriate topic and problem.

We would like to invite you to work along with your student as he or she selects, investigates and reports on an appropriate area of science. With your interest and encouragement, your student can develop the skills and attitude he or she needs to make the project a valuable experience. Guide your child, but let the final project reflect your student's individual effort and design.

A successful fair project does not have to be expensive, time consuming or complicated. However, it does require some planning and careful thought. Projects become frustrating to students and parents when they are left to the last minute and are overly complex. You can't rush good science!

To help you and your scientist in-training prepare, we have included guidelines and resources. These guidelines will offer some helpful hints on how to create an effective project.

Let the investigating, questioning, experimenting, and analyzing begin!

Selected fifth grade projects will be celebrated at the District's Science Showcase on February 8, 2019.

Park City School District Science Fair Rules

1. Students may enter a project individually or as a part of a group of no more than 3 students.
2. No open flames, dangerous or illegal chemicals, liquids, explosives, or live animals permitted on site.
3. You may take pictures of your project if you use something you may not have at the display. You may not have pictures of individual faces on the board without permission.
4. No growing bacteria of any kind at home.
5. Experiments that harm animals are not permitted.
6. Exhibits must be self standing and no larger than 36" wide/high x 24" deep.
7. Students are responsible for supplying all items needed for their display—including extension cords, etc. The school supplies tables only. Please indicate special needs (electrical outlet, extra space, etc) when registering online. We will do our best to accommodate.

PCSD is following the rules and regulations of the University of Utah Science and Engineering Fair (USEF). It may be helpful to visit and become familiar with the Salt Lake Valley Science and Engineering Fair website. **https://usef.utah.edu**

Selected/Winning students (5th grade and higher) will have the opportunity to compete in the regional University of Utah Science and Engineering Fair, held in March at Rice Eccles Stadium at the University of Utah's campus in Salt Lake City. The USEF is an annual science competition for students in grades 5-12 from the Canyons, Granite, Murray, Park City, Salt Lake and Tooele School Districts as well as the Salt Lake Catholic Diocese.

Students who will advance to the USEF will be required to complete a registration form online for that fair. Information and direction will be provided to those students at the completion of the Park City District Showcase.

At the USEF projects compete against all other projects within their division and within their chosen category. The divisions are as follows: Elementary Division – grades 5-6; Junior Division – grades 7-8; and Senior Division – grades 9-12. **Please note that all judge decisions are FINAL.**

The schedule for the USEF may be seen at this link.
https://usef.utah.edu/the-event

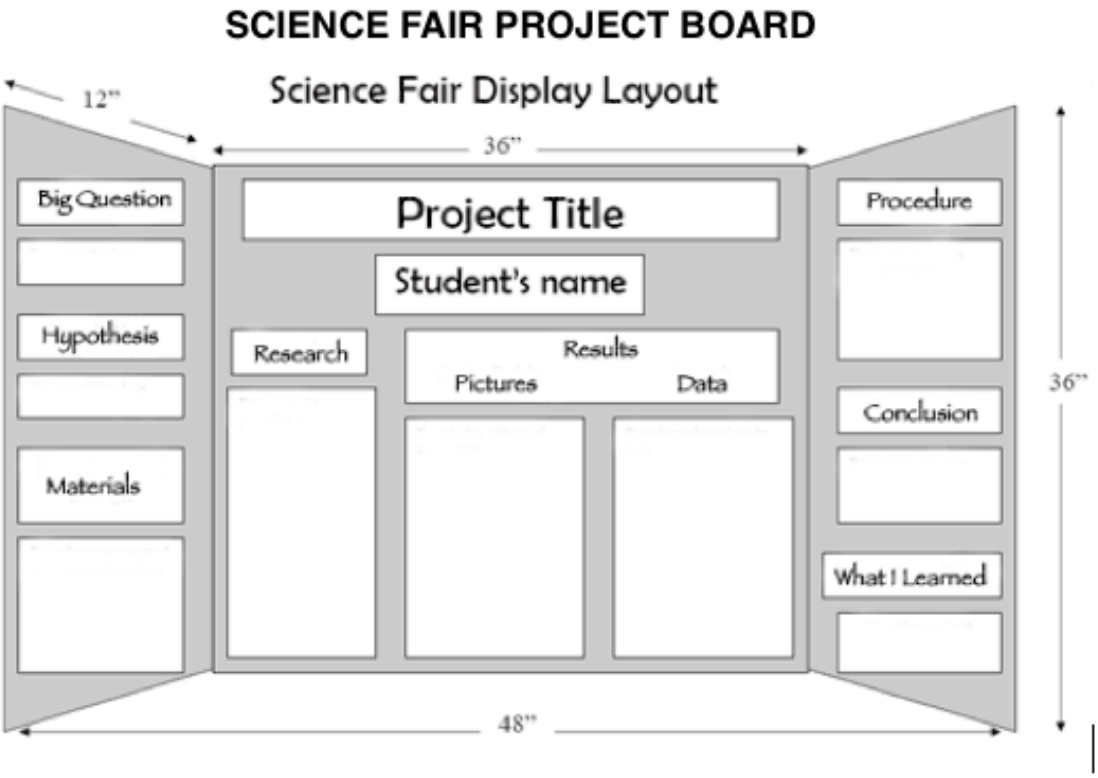
Judging Projects:

Projects submitted by 5th – 12th graders will be judged with the USEF rubric. USEF asks that students demonstrate an understanding of the scientific method.

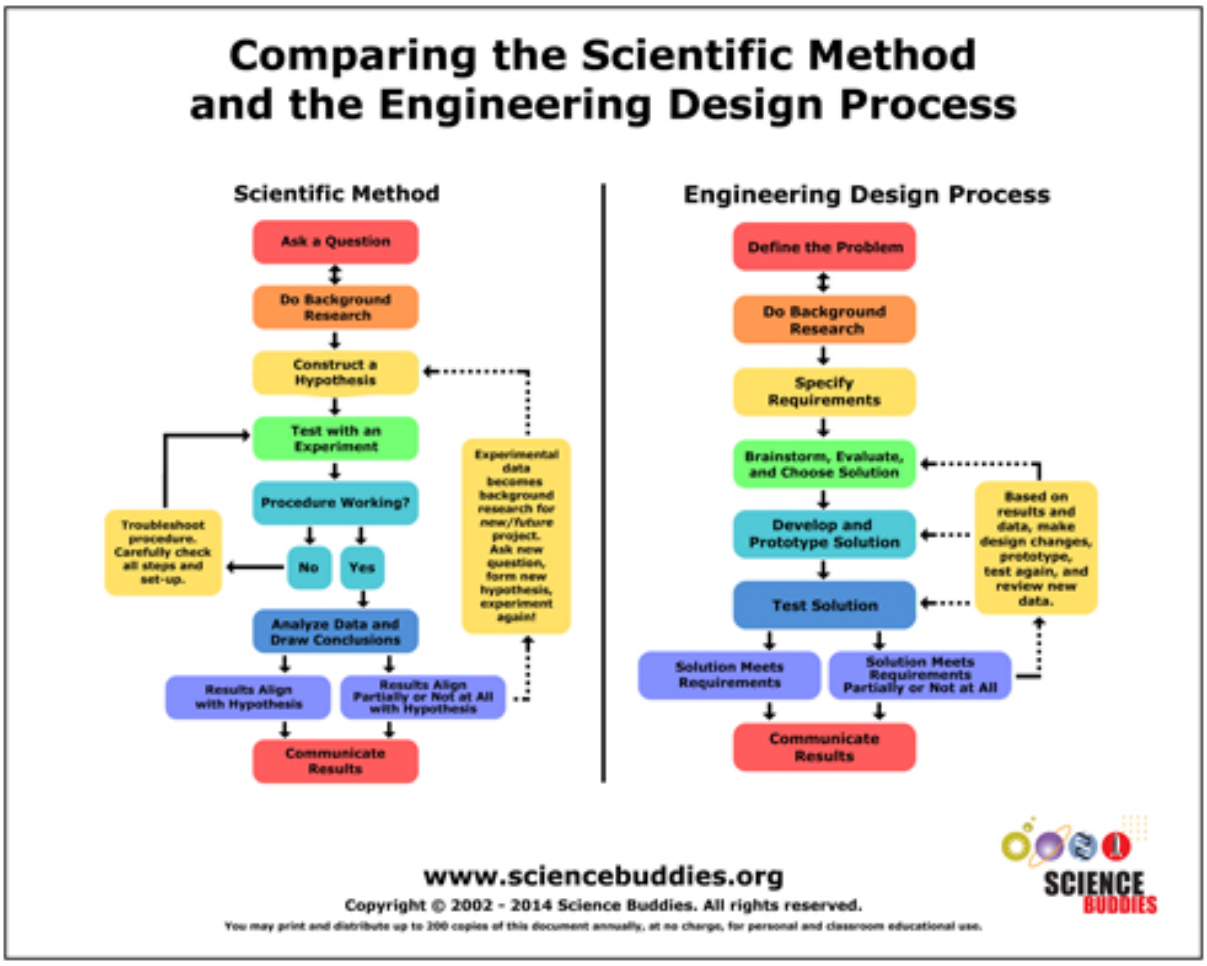
Each project is judged on its own merits according to the following criteria:

- Project Objectives or Problem Statement
- Design & Procedures
- Data & Results
- Discussion & Conclusions
- Interview & Display
- Teamwork (for team projects)

When scoring a project, judges rely on material provided on the project board, project notebooks (required for Junior & Senior Divisions, optional for Elementary Division) and other pertinent items on display, but most importantly on the student interview.



Pts.	Evaluation Criteria	Excellent 17-20 points	Good 13-16 points	Fair 9-12 points	Poor 0-8 points
20 score	**Science Project:** • Objectives	-- Clearly stated & well-written -- Appropriate for grade level & original -- Creative approach to problem solving	--Lacking in **1** area: clarity, appropriate level, or creativity	--Lacking in **2** areas: clarity, appropriate level, and/or creativity	--Poorly conceived or lacking in all **3** areas
	• Hypothesis *(question)*	I. Testable, clear, bounded hypothesis	I. Hypothesis present, but not completely testable	I. Hypothesis incomplete or not testable	I. Hypothesis **missing** or poorly defined
	• Use of Resources* ****jr/sr projects only***	– A comprehensive, correctly formatted bibliography was included & footnotes are present in text and display – Student(s) used full resources available (e.g. labs, advisors, experts, scientific periodicals & texts, internet)	– Incomplete citations – Used **most** available resources – **Most** internet resources are scientific & reputable	– **Minimal** effort on citing sources – Used **some** available resources – **Some** internet resources are scientific & reputable	– **No** sources or citations – Project suffered as a result of **not** using available resources – Internet resources are **not** scientific or reputable
	Engineering Project:				
	• Problem Statement *(design criteria)*	A. Clear, original problem statement that meets potential users' needs B. Clearly defined design criteria and goals	A. Statement is **not** original B. Goals/criteria are measurable but **vague**	A. **Incomplete** statement B. Goals/criteria are **poorly defined**/not measurable	A. Statement **missing** or poorly defined B. Goals/criteria **missing**
20 score	**Science Project:** • Design & Procedures *Experimental design & implementation (hypothesis testing)*	I. Exemplary, creative plan to support / refute hypothesis with valid testing II. Sequential experimental procedures are quantitatively and/or qualitatively listed, and connect hypothesis, data & results III. Procedures are logical and repeatable IV. Sample sizes, number of trials are sufficient. Valid control group. V. All other variables are carefully controlled	I. Sufficient plan to support / refute hypothesis with all other criteria met, **or** II. Exemplary plan and **3** of **4** other criteria for excellence met, **or** III. **Some** improvements needed throughout	I. Sufficient plan with **3** of **4** other criteria for excellence met, **or** II. Exemplary plan and **2** of **4** other criteria for excellence met, **or** III. **Major** improvements needed throughout	I. Sufficient plan with **1-2** of **4** other criteria for excellence met, **or** II. Plan information is unclear / missing / insufficient, **or** III. Criteria II-V are **lacking** or grossly defficient
	Engineering Project:				
	• Engineering process *(design & prototype)*	A. Design goals & approach clearly stated & reproducible, alternatives considered B. Design creative, schematics / software provided (as applicable), well labeled C. Assembly details or set-up instructions for device are clearly laid out D. Photos provided or prototype on display E. Materials used in appropriate ways	A. **3-4** of 5 criteria required for excellence are met **or** B. **Some** improvements could be made	A. **1-2** of 5 criteria required for excellence are met **or** B. Existing information is **incomplete**, or needs **major** improvement	A. Description of design & implementation not included or **inadequate** to show how design works and/or if design meets requirements B. No engineering. Project was merely **tinkering**.
20 score	**Science Project:** • Data & Results *(experimentation)*	I. Experiments run are appropriate for hypothesis being tested II. Sufficient data. Repetition of experiments III. Correct & appropriate statistical tests run	I. **2** of the **3** criteria for excellence met II. **Some** improvements could be made	I. **1** of the **3** criteria for excellence met II. **Major** improvements required	I. **Incorrec**t experiments and data analysis for hypothesis II. **Insufficient** data
	• Documentation* *(notebook)* ****jr/sr projects only***	– Clearly written, complete and clear – Procedures are easy to follow – Comments, observations included – Records include dates, signatures	– **3** of **4** standards for excellence were met **or** – **Some** improvements could be made	– **2** of **4** standards for excellence were met **or** – **Major** improvements required	– **1** of the standards for excellence were met **or** – No notebook or **missing**
	Engineering Project:				
	• Problem Solution *(testing and redesign)*	A. Measures of performance/improvement have been made (including cost) B. Functionality is fully tested & validated C. Records on testing are included D. Prototype was redesigned or potential design improvements were identified	A. Final design **works** but has not been fully tested B. **No advantage** over original C. **Some** improvements could be made	A. Final design does **not** meet end user's needs B. **No improvement** over original C. **Major** improvements required	A. Little or **no** testing B. **No** records C. **No** redesigns
20 score	**Science Project:** • Discussion & Conclusions	I. Status of the hypothesis is correctly and logically addressed, and stated in an unbiased manner (confirmed / refuted) II. Completeness of work and validity of conclusions are substantiated III. Discussion is insightful, demonstrates clear understanding of research project, broader subject & suggested new work	I. **2** of **3** criteria for excellence met, **or** II. **Some** improvements could be made	I. **1** of **3** criteria for excellence met **or** II. Overall information is **lacking** in quality and perspective	I. **No** discussion / conclusions provided
	Engineering Project:				
	• Evaluation	A. Significance, relevance, applications, utility, cost effectiveness, improvements, benefits and performance addressed	A. **Some** evaluation areas not addressed	A. **Many** evaluation areas not addressed	A. **No** evaluation areas addressed
20 score	**Science+Engineering:** • Interview	Exemplary understanding… – Research findings / design results – Ability to interpret graphs, statistics, etc... – Related background information – Project rational, details & validity	**Good** understanding... – Research findings – Ability to interpret graphs, statistics, etc. – Related background information	**Fair** understanding… – Research findings – Ability to interpret graphs, statistics, etc… – Related background information	**Poor** understanding… – Cannot answer questions adequately and precisely – Does not incorporate display into interview – Unfamiliar with related background information
	• Display	Exemplary display… -- Creativity, clarity, logic, interpretability, construction, writing, graphics, grammar -- All information directly relates to project	**Good** display -- Most information is appropriate, organized and easily accessible.	**Fair** display … -- Some information is appropriate, organized and easily accessible.	**Poor** display… -- Confusing, unorganized, incorrect or inappropriate information



Presentation or display board: All students need to create a display for your project so your ideas can be shown at the fair. The display should have these things or qualities:

- It should be physically sound and durably constructed, and able to stand by itself
- It should show all the steps (1-6) of the scientific method or engineering design process.
- It should be neat, edited and easy to follow.
- A journal recording your thinking, process, and data is to be in the front of the display.
- The items you used and the results of the experiment may be placed in front of the board as long as they follow the fair guidelines.

Oral Presentation: Since it is likely that you will be discussing your project with a judge, practice a short oral presentation before going to the fair. Know these things:

- What scientific information you learned in your research
- What you did at each step in the scientific problem solving process
- What you learned from your project
- What new questions you have
- What you would change if you did the experiment again

TIPS FOR A GREAT PROJECT

1. **Work on something you are interested in.** You don't need to know all about your topic when you start. That is the whole idea of doing research. Good projects are ones that you have fun with.
2. **Start early.** This gives you more time for research and to polish your presentation.
3. **Get lots of help.** There are many people that can help you with your project: teachers, mentors and parents. They can't do your project for you but they can teach you about all sorts of things including how to use tools needed for your research. Visit Science Buddies website at www.sciencebuddies.com
4. **Make a plan.** It takes time to learn and do research. Your teachers plan out the entire year for courses you take. You need to meet deadlines too but you can keep your schedule simple. Keep track of things you need to do like creating an abstract, doing research and writing a research paper (suggested for junior and senior division).
5. **Project Journal.** A journal is your most treasured piece of work. Accurate and detailed notes make a logical and winning project. Good notes show consistency and thoroughness to the judges, and will help you when writing your research paper.
6. **Visual Display.** You want to attract and inform. Make it easy for interested spectators and judges to assess your study and the results you have obtained. Make the most of your space using clear and concise displays. Make headings stand out, and draw graphs and diagrams clearly and label them correctly. But any display you assemble must follow our Safety and Display guidelines.
    - **A 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 exhibited at the fair, but are an important part of the project. You might want to take photographs of important parts/phases of your experiment to use in your display. Photographs or other visual images of human test subjects must have informed consent.
    - **Be Organized.** Make sure your display is logically presented and easy to read. A glance should permit anyone (particularly the judges) to locate quickly the title, experiments, results, and conclusions. When you arrange your display, imagine that you are seeing it for the first time.
    - **Eye-Catching.** Make your display stand out. Use neat, colorful headings, charts, and graphs to present your project. Home-built equipment, construction paper, and colored markers are excellent for project displays. Pay special attention to the labeling of graphs, charts, diagrams, and tables. Each item must have a descriptive title. Anyone should be able to understand the visuals without further explanation.
    - **Correctly Presented & Well Constructed.** Be sure to adhere to size limitations and safety rules when preparing your display. Display all required forms for your project. Make sure your display is sturdy, as it must remain intact for quite a while.

Do your best on all project aspects. Great research does not make a great project if you do not present it well.

THE SCIENTIFIC METHOD

The scientific method is a way to ask and answer scientific questions by making observations and doing experiments.

Area of Science: To begin, you need to pick an area of science in which you are interested. These include: biological, physical, earth, chemical, behavioral/health and environmental.

Scientific Problem Solving Process: After deciding on an area of interest, use the following scientific problem solving process (steps 1-6 below) that will prepare you and guide you through your experiment and project preparation. **Be sure to log or record everything that you do into a journal or bound notebook.**

1. Purpose, Problem or Question: The purpose shows that the project intends to solve some problem from which others can learn or benefit. The problem statement or question should be clearly written and easy to understand.

2. Research or Background Information: Once the purpose has been stated, begin researching the topic. Be through and record all information in your journal. Check out library sources such as science books and magazines. Learn from past studies on some experiments that have already been done. Seek out experts and technology sources on your project subject.

3. Hypothesis: The hypothesis is your prediction as to what will happen as a result of the experiment. Predicting the expected results of this scientific study is based on consistent conditions, exact measurements and thorough research.

4. Experiment or Procedure: The experiment is to test the hypothesis for correctness. There are four parts to the experiment:

- Write a materials and equipment list you will need
- Write a step-by-step process you are going to follow
- Identify the experimental variable that is going to change and the control variables (or unchanged variables)
- Conduct the experiment

As you do the experiment, collect the data you observe by writing them in your journal or notebook. Pay attention to correctness in measuring and observations. Do the experiment at least 3 times, always keeping the conditions of the experiment the same.

5. Analysis or Results: The analysis is deciding what the data means. This can be done by asking the following questions:

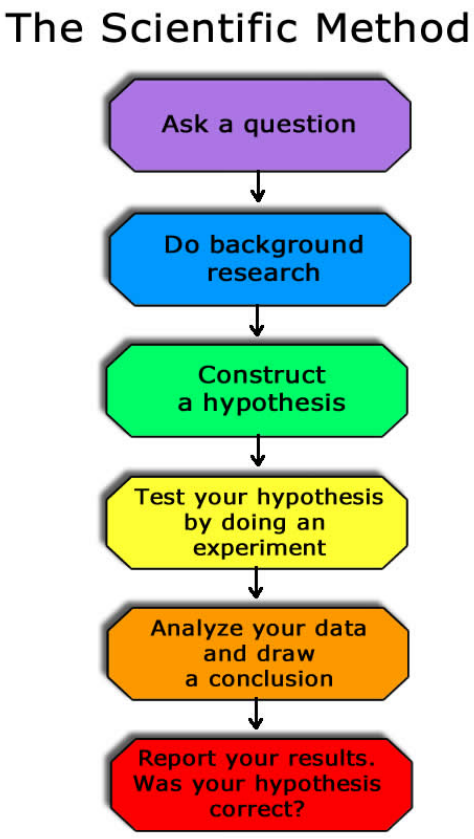
- What happened?
- What steps were important?
- How do the outcomes compare to the hypothesis?

- What observations during the experiment were expected or unexpected?
- What does the data mean?
- What are the first-thought conclusions?

The best way to display the data is to put it as a graph or a chart. A graph is a "picture" of your results. In a scientific investigation the experimental variable is always written at the bottom of the graph (horizontal axis). The information that you collected by measuring, weighing, or timing is recorded up and down on the left side of the graph (vertical axis).

6. Conclusion: The conclusion is the summary of your experiment. It would answer questions such as:

- Did the results confirm or conflict with the hypothesis
- What was learned form the experiment?
- Are there any suggestions or new questions to investigate?
- In what way was this investigation important?
- Is there anything that could be changed to make it a better experiment next time?



ENGINEERING DESIGN PROJECT

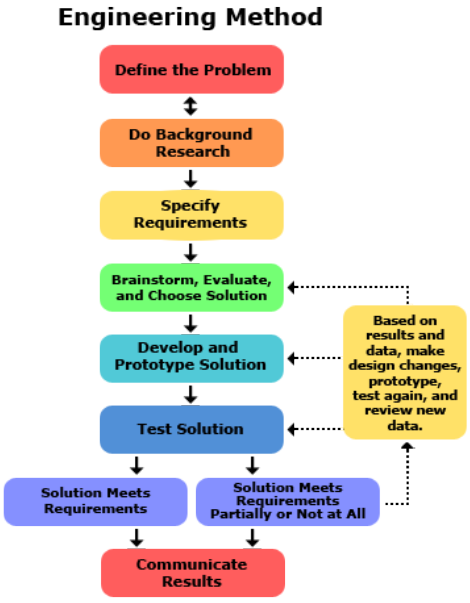
The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product
(like a machine or computer code) that meets certain criteria and/or accomplishes a certain task.

This process is different from the scientific method. If your project involves making observations and doing experiments, you should probably follow the Scientific Method. If your project involves designing, building, and testing something, you should probably follow the Engineering Design Process.

The steps of the engineering design process are to:

- Define the Problem
- Do Background Research
- Specify Requirements
- Brainstorm Solutions
- Choose the Best Solution
- Do Development Work
- Build a Prototype
- Test and Redesign

Be sure to log or record everything that you do into a journal or bound notebook.



RESOURCES

The University of Utah Science and Engineering Fair is Park City's regional fair. The USEF provides many tools to assist students in preparing their projects. Please visit their website **https://usef.utah.edu**

Determining the project often requires the most time. Often the best projects stem from a student's personal interests. Review the scientific method and engineering design process and begin looking for the questions or problems that may be investigated.

The library has many books on project ideas.

Helpful websites:

http://school.discovery.com/sciencefaircentral/
sciencebuddies.org (Has helpful questionnaire for students)
http://www.ipl.org/div/projectguide/
http://www.stemnet.nf.ca/sciencefairs/
http://www.exploratorium.edu/snacks/
http:///www.education.com