Iron Springs Elementary

Science and Engineering Exhibition handbook



2014-2015

February 23, 2015

Dear Parents,

 We are so excited to announce the first annual **Iron Springs Science and Engineering Exhibition**. In order to avoid any confusion this Exhibition will be taking the place of our school science fairs from years past. The differences between the “old fairs” and the Exhibition are as follows:

* No Judging
* No District Fair
* 1-2 person projects allowed (if required by teacher then will need to have prior approval)
* No trophies or medals
* K-5 Exhibition will be held all on the same day (Wed. March 25th /8:30-12:00)

This concept of a Science and Engineering Exhibition grew out of a realization that many kinds of learning experiences, both in and beyond the classroom contribute significantly to the education of students. Our Exhibition will provide a valuable opportunity for our young people to be creative, to have pride in their work, and to experience the hands-on use of the scientific and engineering methods. The goal of having a K-5 Science and Engineering Exhibition is to help students become more and more proficient in their scientific/engineering methods and communication skills so that by eighth grade, and continuing into high school, they will be adept at generating and solving highly challenging problems with original experimentation.

 **STEM** is an acronym for **S**cience, **T**echnology, **E**ngineering, and **M**athematics.  The idea of emphasizing these subjects in delivering the curriculum has been driven by the business community, with the goal of preparing a competitive workforce.  It is important to note that STEM is not a program, but a philosophy.  In the real world, content knowledge is interwoven and layered not experienced in isolation as in past traditional educational settings (separate math time, separate science time, etc.).  STEM skills are vital for success in the 21st century and critical to our collective future. The "Critical C's" of Collaboration, Cooperation and Communication are emphasized through [project-based learning](http://stemeducation.edublogs.org/2011/11/14/hello-world/%22%20%5Co%20%22%22%20%5Ct%20%22_blank), usually through interdisciplinary (across subjects) activities. STEM provides the underpinnings for every child to be successful in college, work, and life. STEM learners are problem solvers, innovators, inventors, and logical thinkers. They are able to immediately take advantage of opportunities through post-secondary institutions and businesses.  As you know, science, technology and engineering are basic skills expected by employers. Our students will be expected to make some of the toughest decisions of any generation, based on their understanding of emerging science and technology. Where will the technologists, engineers, and innovators of the next generation come from? How can we stop the erosion of interest in science, technology, engineering, and math? We, as teachers, would like to inspire that creativity and innovation in our students to help with career exploration and development.

 We would like to welcome all K-5 students to join us in this wonderful opportunity. Each student will now be given the chance to develop their skills in critical thinking, problem solving, communication, and organization without the stress of “winning” that comes with regular science fairs. It also gives students the opportunity to explore their unique interests in science and engineering. Most of all it makes learning engaging and fun! Remember that the aim of education should be to teach us rather than how to think, what to think-rather to improve our minds, so as to enable us to think for ourselves. If your child is interested in participating they pick up an ISE Science & Engineering Handbook from their teacher. This handbook will contain all the information needed to complete a project for the Iron Springs Elementary Science and Engineering Expo.

Natalie P. Clark Science and Engineering Exhibition Facilitator

Science and Engineering Exhibition Dates

 **Wednesday, March 25, 2015 (8:30-12:00)**

1. Make sure your **Project Selection/Registration Form** is handed in to Mrs. Wilson or Mrs. Clark by:

 Monday, March 9, 2015. The **Project Selection/Registration Form** must be filled out in its entirety.

2. I **MUST** have a registration paper from every participant and/or project. This is the **ONLY** way to reserve a spot for your project. Due to the large number of students that will be participating if your registration is not turned in on or before Monday, March 9th 2015 there will not be a spot for your project at the Exhibition. Therefore you will not be allowed to participate in the Exhibition. **NO EXCEPTIONS!**

3. Please pay close attention to the registration forms. There is a project form for those students that are doing aproject on their own and a separate form with different requirements for those students that are doing a project with a partner.

4. Registration will begin at 8:00 a.m. in the lobby at Iron Springs Elementary. **All** projects need to be set

up **by 8:45.**

 5. Students need to return to their classrooms until their class tours the projects.

6.Students will be excused for **lunch at 12:00 (project area has to be cleaned**.)

7. The Exhibition will be open to the school from 9:00-10:45. The Exhibition will be opened to **ONLY** parents/public 10:45-11:50.

Iron Springs Science and Engineering exhibition **Rules**

**The rules outlined must be adhered to without exception.**

***ALL exhibits must be based on scientific principles.***

This year will see a monumental shift in the way our science fair has been handled in the past. The K-5 Science Exhibition will be held Wednesday, March 25th (8:30-12:00). **There will be NO JUDGING this year and there will also not be any advancement to a District Science Fair. There will not be a District Science Fair this year.** 1-2 students per project will be permitted this year as long as it has been cleared through the classroom teacher. If the classroom teacher does not require the project then no prior approval is needed for a 1-2 member team project. Students must complete and turn in the Student Information/Permission Form to Mrs. Clark or Mrs. Wilson in order to show/demonstrate a at the 2015 Iron Springs Science and Engineering Exhibition.

Please take note that plants (except those that fit within the project dimensions), molds, vertebrates, environmental pollutants, and items listed on the rules page which are used in an experiment cannot be exhibited, but the project may be demonstrated through photography, illustrations, and/or diagrams. Liquids that are enclosed in a shatterproof container and sealed so they don’t leak will be allowed only if they fit within those guidelines.

Please emphasize this point to your student so that they will not experience disappointment and surprise on the day of the fair. Any of these prohibited items or items that do not fit within the guidelines, that show up at the fair will either be sent back home or discarded.

 Exhibit size is limited to 30 inches deep, front to back; 48 inches wide, side to side; and 96 inches high, floor to top. (Tables are approx. 30 inches high.) There will be no exceptions.

Proper attention to safety is required of all science fair participants. Anything, which could be hazardous to the public, is **prohibited from being displayed.**  Specifics are listed below:

1. Live organisms pathogenic to man or live vertebrates (i.e. cultures of bacteria or fungi are prohibited; Invertebrates can be displayed only in safe, enclosed containers.)
2. Plants will be allowed if they fit within the project dimensions. Plants must be pre-watered. Poisonous or toxic plants are prohibited.
3. Vertebrate animals, living or dead, and their parts are prohibited.
4. Food, either human or animal may only be displayed in sealed containers. **Note:** The public must not sample food.
5. Do not display syringes or any similar devices.
6. Any flames, open or concealed, are prohibited.
7. Hot plates are prohibited.
8. Do not use any highly flammable display materials.
9. Dangerous chemicals including caustics and acids are not allowed (this includes dry ice). Safe chemicals such as table salt, sugar, bi-carbonate of soda may be displayed in quantities of less than 1 tablespoon
10. Highly combustible solids, liquids or gases are prohibited.
11. Do not use tanks, which contain combustible gases, including butane and propane, both of which are prohibited.
12. Bare electric wires and exposed knife switches may be used only with circuits of 12 volts or less.
13. Any electrical circuits (for 110-volt AC), which do not have an “Underwriters Laboratories” -approved cord of proper load carrying capacity, are prohibited. **Note: You must furnish your own extension cords**. *Please indicate on the registration form if electricity is needed for the project.*

Iron Springs Science and Engineering exhibition

Individual Project Selection/registration Form #1

Return this to the front office by Monday, March 9, 2015

Student’s first and last name (printed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Grade \_\_\_\_\_\_\_ Teacher’s name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\*Parent/Guardian signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The original science question (known as the problem) our project will answer (solve) is:

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Is Electricity needed?(circle one): yes no

My project will be (please check one):

 Collection (Kindergarten & 1st grade only)- You will collect and organize something of interest, answering questions related to observations made while exploring your world. Examples: What kinds of insects can be found in my backyard? What types of tree leaves can be found on my street?

 Experiment (Kindergarten through 5th grade)- You will conduct an experiment to find the answer to your question/problem. Using the Scientific Method will take you through the correct process of asking a question, doing some preliminary research, making a hypothesis (your best guess at how it will turn out), planning and conducting your experiment, and analyzing your results..

 Invention ((Kindergarten through 5th grade)- Everyone is an engineer! You will use science, math, and creativity to dream up and design an object or a process to solve a real life problem. Using The Engineering Design Process will take you through all the necessary steps: asking a question, brainstorming, testing, and making it even better.

 Research Project (Kindergarten through 5th grade)- Someone has already found the answer to your question/problem, and you will look for their answer/solution by reading books, talking to experts, and gathering information from other sources such as schools and public libraries. Your display board will have drawings, photographs, charts, graphs, dioramas, etc. Examples: How does a solar cell work? How does a light bulb operate? How do clouds form?

Iron Springs Science and Engineering exhibition

Partner Project Selection/registration Form #2

Return this to the front office by Monday, March 9, 2015

1. Student’s first and last name (printed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Student’s first and last name (printed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Yes, the project is a requirement for my class. If so, you must have prior approval from your teacher to have a multiple (1-2 people) person project. (This will be verified through each teacher)

Teacher signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

No, the project is not a requirement for my class.

Grade \_\_\_\_\_\_\_ Teacher’s name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\*Parent/Guardian signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The original science question (known as the problem) our project will answer (solve) is:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Is Electricity needed?(circle one): yes no

My project will be (please check one):

Collection (Kindergarten & 1st grade only)- You will collect and organize something of interest, answering questions related to observations made while exploring your world. Examples: What kinds of insects can be found in my backyard? What types of tree leaves can be found on my street?

 Experiment (Kindergarten through 5th grade)- You will conduct an experiment to find the answer to your question/problem. Using the Scientific Method will take you through the correct process of asking a question, doing some preliminary research, making a hypothesis (your best guess at how it will turn out), planning and conducting your experiment, and analyzing your results..

 Invention ((Kindergarten through 5th grade)- Everyone is an engineer! You will use science, math, and creativity to dream up and design an object or a process to solve a real life problem. Using The Engineering Design Process will take you through all the necessary steps: asking a question, brainstorming, testing, and making it even better.

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HELPFUL HINTS FOR PARENTS

This should be a fun project! Success is when your child asks their own question, completes their project with a smile, and knows more than when they started. Enjoy this time of discovery and fun for you and your child!

The science/engineering method project reinforces reading, writing, logic and math skills, and creativity.

The goal is that your child learns “the scientific method” or “the engineering design process”  through direct experience.

For daily reading, recommend your child choose a science book that can be a research resource for their project.

A **Report** is part of the process.

 Type the report *as your child wrote it or dictated it to you*. If the sentence structure is off, ask them if it needs correction. **Guide** them to the correction. (It does **not** have to be typed)

* It is best to guide and answer their questions with questions. You may know the answer, but help them discover it themselves. For example, you may want to show them, which paragraph in the book to re-read rather than giving them the answer.
* Although neatness is good it’s not the main focus. A 6-year-old can make the data chart with a little help. They should do that part while you operate the hot glue gun.
* The project does not have to look store bought. It needs to be made by them, so that they truly get better every year they participate.
* Encourage your child’s artistic side with the display. For example, you can show how the use of color and shapes can be used to show the importance of a part of the display.

What is an acceptable science fair project?

* Something that answers a question to which they do not know the answer
* Something they can figure out themselves
* Something they can change somehow, add another variable, and then predict the outcome. That’s an experiment!

What is NOT an acceptable science fair project?

* Reproducing results found on the web is *not* an experiment; it’s a reproduction.
* A demonstration is not an experiment (i.e., volcano).

TYPES OF PROJECTS

\*Invention Project (Kindergarten through 5th grade)

Steps of the Engineering Method

* The engineering design process is the set of steps that a designer takes to go from first, identifying a problem or need to, at the end, creating and developing a solution that solves the problem or meets the need.
* 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**
* During the engineering design process, designers frequently jump back and forth between steps. Going back to earlier steps is common. This way of working is called **iteration**, and it is likely that your process will do the same!
* Engineers create new things, such as products, websites, environments, and experiences.
* If your project involves making observations and doing experiments, your project might better fit the Steps of the Scientific Method
* If you are not sure if your project is a scientific or an engineering project, you should look at the comparison chart between the Engineering Design Process and the Scientific Method.

# \*Science Project (Kindergarten through 5th grade)

# Steps of the Scientific Method

* The scientific method is a way to ask and answer scientific questions by making observations and doing experiments. Scientists study how nature works.
* The steps of the scientific method are to:
* **Ask a Question**
* **Do Background Research**
* **Construct a Hypothesis**
* **Test Your Hypothesis by Doing an Experiment**
* **Analyze Your Data and Draw a Conclusion**
* **Communicate Your Results**
* It is important for your experiment to be a fair test. A "fair test" occurs when you change only one factor (variable) and keep all other conditions the same.
* While scientists study how nature works, engineers create new things, such as products, websites, environments, and experiences.
* If your project involves creating or inventing something new, your project might better fit the steps of the Engineering Process
* If you are not sure if your project is a scientific or an engineering project, you should look at the comparison chart between the Engineering Design Process and the Scientific Method.

TYPES OF PROJECTS CONT…(page 2)

# While scientists study how nature works, engineers create new things, such as products, websites, environments, and experiences. Because engineers and scientists have different objectives, they follow different processes in their work. Scientists perform experiments using the scientific method whereas; engineers follow the creativity-based engineering design process.

Both processes can be broken down into a series of steps, as seen in the diagram and table below.



|  |  |
| --- | --- |
| The Scientific Method | The Engineering Design Process |
| State your question | Define the problem |
| Do background research | Do background research |
| Formulate your hypothesis, identify variables | Specify requirements |
| Design experiment, establish procedure | Create alternative solutions, choose the best one and develop it |
| Test your hypothesis by doing an experiment | Build a prototype |
| Analyze your results and draw conclusions | Test and redesign as necessary |
| Communicate results | Communicate results |

TYPES OF PROJECTS CONT…(page 3)

**Why are there two processes?**

Both scientists and engineers contribute to the world of human knowledge, but in different ways. Scientists use the scientific method to make testable explanations and predictions about the world. A scientist asks a question and develops an experiment, or set of experiments, to answer that question. Engineers use the engineering design process to create solutions to problems. An engineer identifies a specific need: **Who** need(s) **what** because **why**? And then, he or she creates a solution that meets the need.

## Which process should I follow for my project?

In real life, the distinction between science and engineering is not always clear. Scientists often do some engineering work, and engineers frequently apply scientific principles, including the scientific method. Much of what we often call "computer science" is actually engineering—programmers creating new products. One thing to remember is if the objective of your project is to invent a new product, computer program, experience, or environment, then it makes sense to follow the engineering design process.

\*COLLECTION PROJECTS (Kindergarten & 1st grade only)

Collect and organize something of interest, answering questions relating to observations made while exploring your world.

1. Problem…(Your question)

Choose a topic that you are interested in learning more about. Ask a one sentence **question** that you will find the answer to by collecting something: Examples: What kinds of insects live in my yard? What kinds of leaves grow in my neighborhood? What different kinds of rocks can be found out at the Three Peaks Recreation Area?

2. Hypothesis

A **hypothesis** is what you think will be the answer to your question. It is your “best guess” before you actually go and collect your evidence. It is written as one sentence. Example: In my yard, there are these kinds of insects: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Collection (Experiment)

* **Materials**:Think about all the materials you will need to gather and sort your collection.
* **Collect and Sort**: Time to go and collect! Once you’ve gotten your collection together, sort it in two or more different ways.
* **Observe and Record Data**: Take pictures, do drawings, charts and graphs of all the ways you sort your collection. See what it looks like.
* **Results**: Compare and evaluate the different pictures, drawings, charts, and graphs you did for your collection. What do they tell you? Evaluate the results.

4. Conclusion

The **conclusion** answers the hypothesis. Look at the results and figure out if they prove or disprove your hypothesis, and why.

TYPES OF PROJECTS CONT…(page 4)

**COLLECTION PROJECT WRITTEN REPORT REQUIREMENTS**

**Purpose**

* What did you collect?
* Why did you choose that to collect?
* What did you want to find out?
* What things will you compare

**Problem (Question)**

This is your question-this is what you want to find out.

**Hypothesis:** This is what you think the answer might be.

**Collection**

This is the collection that answered your question.

* List of all the things used.
* Sort collection in different ways
* Record (pictures, graphs, charts, etc.) all of the ways you sorted.
* Tell why you sorted them in these ways.

**Conclusion**

What was the answer to your problem or question?

\*RESEARCH PROJECTS (Kindergarten through 5th grade)

    PROBLEM- State what it is you are trying to solve in your research.  This should be written in the form of a question.  It should also explain the purpose of doing this form of research paper.

    HYPOTHESIS-This should be written before you do any of your experiment. Give your best “guess” for the answer to your proposed question, which you stated earlier.

    EXPERIMENTAL DESIGN- Explain everything you did to set up your research experiment. This will include background information about where you obtained samples, what the area looked like, dates and times, and exact locations of samples.

    EXPERIMENT OR TEST HYPOTHESIS- Starting at the beginning, explain what you did on a daily basis to test your hypothesis.  You need to explain everything you did, equipment used, and how you set up your research.

   COLLECTION OF DATA- Document your daily observations, changes that took place, drawings, charts, data tables, times, etc.  Only observable information belongs in this section.  Observe and record.  Date all observations correctly.

    ANALYSIS OF DATA- Review your recorded data. Use the data to explain why certain things happened and why/how you reached your conclusion to your research.

    CONCLUSION-    State your conclusion. Did your research support your hypothesis?  Whether your hypothesis was supported or not give an explanation of how/why you came to that conclusion.

Scientific Method Project Ideas

**Plants**

 How does the duration of light affect plant growth?

 How does the color of light affect the growth of plants?

 What are the effects of temperature on the germination of bean seeds?

 What is the effect of spacing on the growth of radish seeds?

 How does magnetism affect the height of bean seeds?

 What is the effect of different soil mixtures on plant growth?

What is the effect of planting depth on the germination of seeds?

To what extent do various concentrations of salt water affect plant growth?

**Human Body**

How does vision effect the sensation of taste?

 What is the effect of age on reaction time?

 To what extent does age effect the sensation of hearing?

 To what extent does age effect the sensation of smell?

 What is the effect of exercise on pulse rate (or blood pressure)?

 What is the effect of walking/skipping/running on respiration rate?

 What is the effect of left/right handedness on reaction time?

 To what extent does the amount of light affect the acuity of vision?

 How does color affect the perceived taste sensations of noncarbonated beverages?

 Does listening to different types of music affect how well you can perform mental tasks?

 Does watching T.V. affect how well you can perform mental tasks?

**Earth & Space**

 Does the sun rise at the same time and in the same location in the sky?

 Are the amount of hours of daylight and night the same year round?

 Does the moon rise at the same time and in the same location in the sky?

 What is the effect of freezing temperatures on rocks?

 To what extent do different types of soils retain water?

 What is the effect of rain on soil covered with different types of foliage?

 What is the effect of wind on different mixtures of soil?

 What is effect of temperature on crystal growth?

 What is the effect of temperature on the evaporation of water?

 What is the effect of air pollution on precipitation?

**Physical**

How do light filters affect perception of color of objects?

 How do different solids affect the transmission of sound?

 How does the length of a vibrating body affect the sound?

 What is the effect of temperature on the volume of air?

 What is the best shape for a kite to lift off quicker?

 How do different fabrics affect heat loss from an object?

 To what extent does temperature affect the height that a ball will bounce?

 How does the density of an object affect its buoyancy?

Engineering Design Project Ideas

**Flight Engineering**

Design, test, and improve…

* ways weight (ballast) can be used to balance longer wing length to achieve the longest flight of a model airplane.
* the wingspan of a fixed propeller model airplane to increase its flight air time.
* an air powered model hover craft.
* safety restraints for infants traveling on aircrafts.
* comfortable seating for longer flights

**Mechanical Engineering**

Design, test, and improve…

* your favorite furniture
* your favorite sports equipment
* ways to crush plastic recycling to save trash container space
* a soap container that quickly cleans garden tools
* a wind powered device that moves water up hill
* a rubber band powered cart or train (connected cars)
* a steam powered model car or boat
* a hand powered coin sorter
* a mechanical arm that throws balls to a hitter

**Waste Recycling Engineering**

Design, test, and improve…

* a system to insure all paper, plastic, and/or aluminum cans are being recycled properly
* a trash can that motivates kids to sort recyclables properly
* a way to keep people from disposing of harmful liquids and solids down the sink drain
* a way to reuse old school uniforms
* inexpensive and safe ways to compost vegetation and/or food scraps back into soil

**Energy Conservation Engineering**

Design, test, and improve…

* a portable solar powered chocolate s’more cooker
* an LED clock powered by a fruit or veggie battery
* a mega strong electromagnet
* a hydro-electric powered paper cutter
* a wind powered LED light reading visor
* a solar powered personal fan for a baseball cap
* a solar powered speed racer

Statement of Philosophy

 This project of a Science and Engineering Expo grew out of a realization that many kinds of learning experiences, both in and beyond the classroom contribute significantly to the education of students. Science Expos provide a valuable opportunity for young people to be creative, to have pride in their work, and to experience the hands-on use of the scientific and engineering methods. The goal of having a K-5 science expo is to help students become more and more proficient in their scientific method and communication skills so that by eighth grade, and continuing into high school, students are adept at generating and solving highly challenging problems with original experimentation.

Objectives of Site Expo

1. To emphasize and support state science standards and literacy skills.
2. To provide a focus for students to apply skills and concepts learned in science, art, computer science, math, and reading/language arts.
3. To help students develop self-reliance, organizational skills, and productive work habits.
4. To provide our schools and community with the opportunity to recognize and encourage student interest in science.