CVUSD Science and Engineering Fair
Student Guidebook
2023-2024

Student's Guide to Science and Engineering Fair

What is a Science and Engineering Fair?
A Science and Engineering Fair is a competition of student science projects, held each year at your school, in your district, in your county, and in the state of California.

What will taking part mean to you?
Participating in a science fair means that you will have the opportunity to:

- develop and display a science project of your choice
- share your creative abilities, knowledge, and interests with other students
- meet and talk with scientists in your field of interest
- be recognized and feel satisfaction for a job well done
- compete for awards, which range from certificates, ribbons, and medals to industry tours, cash prizes and scholarships.

What is a science project?
A science project is an active "fun" approach to science, something you do rather than something you only read about or watch someone else do.
A science project is an investigation of a question about a science topic that interests you. The difference between this kind of project and other ways of working on a problem is the use of a systematic plan called the Scientific Method, or the Engineering & Design Process.

What is the Scientific Method?
The Scientific Method is a way of working on a problem using a series of related steps. In brief, these steps are as follows:

Step 1: Identify and state the problem (usually as a **question**) and purpose of the investigation.

Step 2: **Research** the question - find out what is already known about the problem from reading and talking to experts. This gives you a place to start and helps ensure your project is original.

Step 3: Form a **hypothesis**- write a statement expressing your predicted answer to your research questions. Include the research that led you to form this statement.

Step 4: Plan an **experiment** that will test your hypothesis. Your experiment should compare a control group or situation with a test group or situation. Describe how you will do the experiment (your procedure or **method**). List your **materials**. The order in which you do the procedure is called your protocol.

Step 5: Do the experiment. Record all your information, observations, measurements, charts and graphs in a **journa**l. Display your **data** as graphs, histograms, and data tables.

Step 6: State your **conclusion**— tell what happened in the experiment, whether your experiment supported or refuted the hypothesis. Tell what you learned.

Will you have to do an experiment to qualify for the Science and Engineering Fair?

There are many ways to participate in the Science Fair. Ask your teacher for suggestions to get you started. Your project must show that you can use the Scientific Method or the Engineering & Design Process.

Generally, this means you must do an experiment. The Mathematics & Software category does seek to provide additional rewards for other creative abilities. Even here, a project is stronger if the Scientific Method has been used to organize or communicate the content of your project.

All Students

1. Need to complete the appropriate forms to register.
2. Need to submit all items to Science Coordinator to upload to the CVUSD Google Drive.
3. Need to download all necessary forms. (Links provided in Section 2.)
4. Elementary students in grade 4th and 5th should fill out only EZ form. Contact your teacher or site administrator if you have questions. (6th Grade has additional forms, See Section 2.)
5. All forms and digital documents must be submitted to the Science Coordinator and uploaded to the CVUSD Google Drive by **January 19, 2023**.

Student process Overview

1. Choose a Science Fair Project:
    a. **How to Do a Science Fair Project**
2. Complete and fill out necessary forms
3. **District Project Display Information**:
    a. Begin your project. Make sure you include all the components of the Scientific Method.
    b. Create your backboard/Quad Chart and Slide Presentation.
    c. Create your video
        1) Include: Students Name(s), Title of the project, Abstract, Project information, Data, Conclusion, and References
        2) Examples of Junior division videos (Broadcom MASTERS winners)
            a) Elementary - 3 minutes max
            b) Junior Division (Grades 6-8) - 5 Minutes max
            c) Senior Division (Grades 9-12) - 5 Minutes Max
    d. Upload Video and Project Presentation to CVUSD Google Drive
4. Judging Standards
5. Engineering and Invention Project Guides
6. Discouraged Projects
7. Explanation of Roles for Senior Division
8. Division Project Categories
9. Examples of Backboards, Abstract, and Quad Chart

1. Choosing a Science Fair Project

Selecting a Project Topic

Selecting a project often appears to be a difficult task. Fortunately, projects do not need to be highly complex in order to be successful. When choosing your subject, pick a question that interests you, as you may be working on it for a while! If you are more interested in building something that can solve a problem, read the information on Engineering Projects.

- Look at the world around you
- Hobbies
- Something that bothers you and can be changed
- Something that can improve the world

Find subjects that interest you and start to formulate questions about them. Narrow the questions down to something you might be able to investigate within a few months.
If you need ideas for science projects here are some suggestions:

For inspiration, check out a web site like:

- http://www.sciencebuddies.org/ - The ScienceBuddies.org website has a worksheet which suggests projects based on your expressed interests.
- http://www.societyforscience.org/ISEF/
- http://ei.cornell.edu/student/
- http://science.howstuffworks.com/
- http://www.TryEngineering.org

However, do not copy projects or only make minimal changes to a project. Your project should be **original.**

Make sure your project is not a demonstration. You should be able to identify the variables that you will test and be able to record quantitative data. Also remember sample size is important; is this a project you will be able to do multiple times to gather enough data to make your findings reliable?

2. Forms
(Forms can also be downloaded from simsef.zfairs.com)

Elementary (4th-5th)	Secondary Division (6th-12th)
EZ Form	1. Form R-Research Plan
Form R (Optional)	2. Checklist for Adult Sponsor Form 1
	3. Student Checklist Form 1A
	4. Approval Form 1B
	5. Abstract
	IF YOUR PROJECT INCLUDES THE FOLLOWING: -human participants -vertebrate animals -potentially hazardous biological agents - hazardous chemicals activities and devices. Please complete the rules wizard with the assistance of an adult. 6. https://ruleswizard.societyforscience.org ****Your project also must be reviewed by the Chino Valley Unified School District Review Board before project can begin.**

SRC Pre-Approval Questions (Look for this information on the Rules Wizard Website)

Does your project involve...	Form Needed
Interactions and data collection from people in any way? Are you asking people questions? Experiments on yourself? Experiments with people in any way? (Human Subjects)	Certification of Compliance of Research Involving Human Subjects Form Participant Informed Consent Form
investigations using your pet(s)? Fish? Any other animals that have bones? (Non-Human Vertebrate Subjects)	Certification of Humane Treatment of Live Vertebrate Animals Form
The use of any chemicals, such as household or industrial cleaning agents, solvents, metals or organic chemicals (Chemicals)	Risk Assessment
The use or construction of model rockets? Lasers?	Risk Assessment

UV Light? Radiation? Guns or gun powder? Fire? (Hazardous or Dangerous Equipment)	
Research and Data from a project previously entered into a Science and Engineering Fair? (Continuation Project)	Continuation of Research Form
(DISCOURAGED PROJECT) Collection and growth of mold, fungus, bacteria or viruses? Are you experimenting with anything that could make you sick? Are you experimenting with anything coming from a human or animal body such as cells, teeth, bones, eggs, fluids, blood, urine, or saliva? (Pathogenic Agents, Human or Animal Tissue)	Risk Assessment Form Human and Vertebrate Animal Tissue Form
Research and data collection that is conducted and supervised at a lab outside of the school setting? Research at a Regulated Research Institutional/Industrial Setting?	Certification of Professional Research Support Form

3. District Project Display Information

3a. Begin Your Project

Once you have decided on the project you want to do, it's time to plan and gather your materials.

Step 1: Identify and state the problem (usually as a **question**) and purpose of the investigation.

Step 2: **Research** the question - find out what is already known about the problem from reading and talking to experts. This gives you a place to start and helps ensure your project is original.

Step 3: Form a **hypothesis**- write a statement expressing your predicted answer to your research questions. Include the research that led you to form this statement. You can use this phrase: "If I use/do_____, then _____will happen because _____."

Step 4: Plan an **experiment** that will test your hypothesis. Your experiment should compare a control group or situation with a test group or situation. Write in detail to describe how you will do the experiment (your procedure or **method**). List your **materials using metric measurements**. The order in which you do the procedure is called your protocol. You must be able to duplicate your protocol exactly, so make sure it is detailed and all measurements are exact.

Step 5: Do the experiment. Record all your information, observations, measurements, charts and graphs in a **journa**l. Display your **data** as graphs, histograms, and data tables. **You must have multiple trials, so make sure you repeat the experiment at least three times to see if you get the same results**. Make sure you follow the same exact protocol each time you do the experiment.

Step 6: State your **conclusion**— tell what happened in the experiment, whether your experiment supported or refuted the hypothesis. Tell what you learned. Good conclusions include a justification for the experiment. It also includes what you might do differently next time.

3. District Project Display Information

3b. Creating Your Backboard/Quad Chart and Slide Presentation

You have a choice of creating a physical backboard or digital Quad Chart.
(If you are creating a physical backboard, you will take a picture of the board to upload with the rest of your materials to the CVUSD Google Drive.)

If you are creating a digital Quad Chart, see examples in Section 9.
Your slide presentation can be either Google Slides or PowerPoint.

Make sure the slide presentation and any other materials are stored in the CVUSD Google Drive with settings set to "Accessible to all."

Your digital slide show will consist of **12 slides without a Quad Chart**, or **13 slides with a Quad Chart**.

- **Project Title (1-slide)**
- **Problem (1-2 slides)**
  - State the question or problem …
  - Which field in science will you be exploring? (e.g. physics, chemistry, engineering, etc.)
  - What is one (or more) areas in the "real world" that this question or problem is related to? (e.g. flight/airlines, carpentry, golf/baseball/basketball, etc.)
  - Research background information related to your subject. (I.e. If your problem is about what material will keep an area the coolest, you may research how different materials absorb/repel heat; if you are testing what kind of material will hold the most weight, you might research how textiles are made and what makes different materials strong.)
- **Hypothesis (1-slide)**
- **Experiment description with measurements in metric (1-2 slides)**
  - Explain the process to complete the experiment to answer the question or solve the problem.
  - Describe how data will be collected. Do your best to address the problem or question through the steps of the Scientific Method.
- **Pictures of your experiment making sure there are no faces shown (1 slide)**
- **Data chart (1-2 slides)**
  - Describe the actual collected data.
  - Include the number of times and/or number of variables used for each data point.
- **(Optional) Quad Chart (1-slide) See section 9 for examples.**
- **Results (1-slide)**
  - Was the question answered? Why or why not?
  - Was any data or any variables omitted that would have impacted results?
  - How did the use of the scientific method assist in answering the question or solving the problem?
- **Conclusion (1-slide)**
  - Final thoughts - what did you learn after completing this project?
  - Include additional pictures (if desired)
- **What will you do next time? (1-slide)**

3. District Project Display Information
3c. Creating Video

Video Presentation with Judging Questions

Here is your chance to tell the judges about your project. Present your summary of the important points of your project. Be sure to present a clear and organized video. Make sure the video is stored in the CVUSD Google Drive with settings set to **"Accessible to all."**

Video Presentation Time Limits:
- Elementary Division (Grades 4 & 5): 3 minutes max
- Junior Division (Grades 6 to 8): 5 minutes max
- Senior Division (Grades 9 to 12): 5 minutes max

During your video presentation you will need to answer the following questions for the judges:

1. Where did you get the idea for your project?
2. What interests you the most about the subject you chose?
3. Why is your project important in today's society? (How will it help people today?)
4. In general, what were your results and conclusions?

Here are additional questions you can answer within your video presentation:

1. What special skills or equipment did you have to learn to use to develop your project?
2. What is special or distinctive about your project?
3. Explain briefly and simply the goal of your project.
4. Explain why you formulated your particular hypothesis.
5. Were you able to support your hypothesis? Explain.
6. What are some possible sources of error in your project?
7. If you were to do this again, what would you do differently?
8. Is there a practical application for the information you gained from this experiment? If so, what is it?
9. What problems did you encounter in developing and/or conducting your experiment? How did you overcome them?
10. In your research, what did you find that was already known about your project?
11. What resources did you use to acquire the information you needed to set up your project?

12. What questions, if any, were created as a result of your work?

13. What are the three most interesting things you learned when doing this project?

3. District Project Display Information
3d. Uploading Video and Project Presentation

MAKE SURE THE VIDEO AND ANY OTHER MATERIALS NEEDED ARE UPLOADED TO THE CVUSD GOOGLE DRIVE WITH SETTINGS SET TO "ACCESSIBLE TO ALL" WITH THE HELP OF AN ADULT.

Note: (If you qualify for the County competition, you will need to upload all materials through the County's zfairs platform. REMEMBER ALSO TO SET SETTINGS TO "ACCESSIBLE TO ALL.")

Class Project	Elementary 4th and 5th	Secondary 6th-12th
One form is required- EZ Form (class)	One form is required- EZ Form	Form R
Digital or Backboard Presentation	Form R (Only if helpful-NOT REQUIRED)	Checklist for Adult Sponsor Form 1
All students must participate in the project	A virtual Quad Chart/Display or picture of display/backboard	Student Checklist Form 1A
Video may be included	PowerPoint or Google Slide Presentation (12 slides **without** Quad Chart or13 **with** Quad Chart)	Approval Form 1B
Two judging categories • TK-2nd • 3rd-5th	An abstract	Abstract (Must download abstract format)
	Digital Research Summary	PowerPoint or Google Slide Presentation
	Digital Science Journal	Video – 5 minutes max.
	Video – 3 minutes max.	Digital Display Board/Quad Chart
		Any other required forms

4. Judging Standards

1. Project Creativity - Originality of the problem, uniqueness of approach and interpretation of data should be commensurate with the student's grade level. Ingenious use of equipment and materials is considered regardless of the expense of the items involved.
2. Scientific Thought/Engineering Project Goals/Mathematics and Computer Project Goals
3. Scientific Method/Process:
   - The project shows depth of study and effort in employing scientific procedures/protocols in the solution of a clearly defined problem (including background study, organized procedures, appropriate sampling, orderly recording and analysis of data and the formulation of logical conclusions).
4. Engineering Project Goals:
   - The project has a clear objective relevant to the needs of the potential user. The product or process has been tested multiple times and is both workable and feasible economically and ecologically.
5. Mathematics and Computer Project Goals:
   - The project has a clear objective, has been thoroughly tested and the process is well documented to both practical and workable outcome(s).
6. Thoroughness
   - The study is complete within the scope of the problem. Scientific literature has been searched, experiments repeated, and careful records kept. And given credit when a citation is needed.
7. Skills
   - Credit is given for special skills needed for the construction or use of equipment and for mathematical, computational, observational, and design skills.
8. Clarity
   - The purpose, procedures and conclusions are clearly explained orally and through the display. The DIGITAL RESEARCH NOTEBOOK is well organized, neat and accurate. Sources of ideas, data, and assistance are clearly identified.

Items to be judged:

1. Project Presentation (PowerPoint)
2. Quad Chart/Display Board
3. Research
4. Lab Notebook/Journal (includes research, data, and scientific notes)
5. Project Abstract

Science & Engineering Fair Judging Guideline Descriptors – Combined

SCIENCE PROJECT CRITERIA	***ENGINEERING PROJECTS***
3 pts. - Clear & focused purpose	Describes a practical need or problem to be solved.
Student should indicate the rationale for their project that ideally serves some greater purpose. There should be a clear idea why the project is useful.	
3 pts. - Identifies contributions to field of study	Definition of criteria for proposed solution.
Should explain how the project further relates to an area of need or [Eng.] what their criteria for success is. How do they know that they've got the desired results?	
4 pts. - Testable using scientific method	Explanation of constraints. The project had a clear objective.
Is their methodology sound? Were all the parts of the scientific method evident? [Eng.] What constraints did the project work under. What did they have to account for?	
5 pts. - Well-designed procedure and data collection methods.	Exploration of alternatives to answer need(s) or problem(s).
Did they collect data in a reasonably scientific way? Was it well thought out or haphazard? Did they collect appropriate scientific measurements and not opinions? [Eng.] Did they explore alternative solutions for their problem? Were there discussions of what other things they could have modified/changed to achieve a similar effect?	
5 pts. - Variables and controls are defined, appropriate, and complete.	Solution is identified, and a prototype/model is developed.
Did they define what they were trying to test? Did they test and/or measure too many things? [Eng.] Did they develop an actual prototype and determine a solution.	
5 pts - Systematic data collection and analysis	Prototype demonstrates intended design.
Was there sufficient data collected to support the conclusion? Was the data collected at appropriate intervals? Was it reviewed along the way? [Eng.] Did the prototype emulate the design as planned? Is it proportional? Does it model appropriately what was intended?	
5 pts - Reproducibility of results	Prototype has been tested in multiple conditions/trials.
Could this experiment be replicated getting similar results by someone else using their procedure? Are the instructions vague? [Eng.] Were there multiple trials or prototypes tested? Was the prototype tested under a variety of conditions where applicable?	
5 pts - Appropriate application of mathematics and statistical methods	Prototype demonstrates engineering skills and completeness.
Was there any analysis of the data that was age appropriate (average, rate, trends, %, etc.)? [Eng.] Does the prototype show a degree of engineering skill or creative ideas/use of materials?	
5 pts - Scientific/Engineering Journal to adequately support the project and research	Scientific/Engineering Journal to adequately support the project and research.
Is there sufficient data collected to support interpretation & conclusion/claim. Is the study complete within the scope of the problem. Scientific literature has been searched and the experiment has been repeated, with careful records kept, and credit given when a citation is needed.	
5 pts. - Project demonstrates significant creativity.	Project demonstrates significant creativity.
How creative was it? Did the student reproduce something that has consistently been done over the years?	

SCIENCE PROJECT CRITERIA	*ENGINEERING PROJECTS*
5 pts. - Logical organization of material	Logical organization of material.
Was the project well laid out? Did the presentation make sense? Could you easily follow along with their methodology?	
10 pts. - Clarity of graphics and legends	Clarity of graphics and legends.
Were graphs and charts used appropriately? Are they labeled with appropriate measurements, titles, axis labels, etc.?	
10 pts. - Supporting documentation displayed including research, graphs, bibliography, and photos	Supporting documentation displayed including research, graphs, bibliography, and photos
Do they have research, bibliography, and/or photos? Is the research appropriate to project? Is the research synthesized or just copied?	

VIDEO PRESENTATION/JUDGE INTERVIEW – THOUGHTS TO CONSIDER - SAME FOR BOTH ENGINEERING AND SCIENCE

- Clear, concise, and thoughtful response to questions.

- Understanding of basic science relevant to the project.

- Understanding, interpretation, and limitation of project outcomes and consequences.

- Degree of independence in conducting project.

- Recognition of potential impact in science, society, and/or economics.

- Quality of ideas for future research. For team projects, contributions to and understanding of project by all members.

-Student information about the project in a genuine, factual manner; explains timelines and steps in the process concisely.

-Student recognizes and discussed potential impacts in science, society, and/or economics.

5. ENGINEERING AND INVENTION PROJECTS GUIDE

The Engineering Design Process is different from the Scientific Method. Instead of testing a hypothesis, students test a design created to meet a specified need. The Engineering & Design Process is more cyclical than the Scientific Method, which can be linear. The main components of the Engineering & Design Process are:

1. Define a need (what, for whom, why)
2. Establish criteria and constraints
3. Research, evaluate alternatives, test plan
4. Construct a prototype
5. Test against established criteria
6. Failure analysis, improve design, and re-test
7. Final documentation

Use this information to help determine the requirements of Engineering Projects and potential areas that will require pre-approval and/or extra safety precautions. A Guide to Engineering & Invention Projects has been developed as an additional resource and provides a series of questions to consider as you begin and design an engineering or invention project.

Engineering and Invention Project Checklist

Consider the answers to the questions below. If the response is yes, then the project may fall under more specific rules and those sections of the International Rules & Guidelines should be consulted.

Hazardous Chemicals, Activities and Devices

Will your project involve any of the following:

† DEA-controlled Substances
† Firearms and Explosives
† Prescription Drugs
† Alcohol & Tobacco
† Regulated Drones
† Radiation

Device Testing with Human Participants

† Are you going to test your project (device, app, invention, prototype, etc.)? If yes, does it require persons to interact with it other than yourself or adult sponsor/supervisor?
† Do you intend to gather background knowledge through a survey or interviews to understand the potential use and needs for your project design?
† Are you going to ask for opinions or suggestions on your project design at any point of the project?
† Does your project intend to gather personal data/have a health benefit to the user?

Vertebrate Animals

† Does your project include any interaction with vertebrate animals in any phase of the project? If yes, please refer to the full Vertebrate Animal Rules.

Potentially Hazardous Biological Agents

† Does your project include any collection, examination or handling of microorganisms, and/or fresh or frozen tissue, primary cell cultures, blood, blood products or body fluids?
† Are you going to culture or isolate any substance, known or unknown? If yes, please refer to the full Potentially Hazardous Biological Agents Rules.

6. Discouraged Projects

First and Foremost, ANY PROJECT IN VIOLATION OF SIMSEF, ISEF OR CALIFORNIA EDUCATION RULES AND REGULATIONS WILL NOT BE ACCEPTED.

Avoid Science Fair Projects That Are Unlikely to be Accepted

1. Effect of colored light, music, or talking on plant growth (OK in 4th grade if variables included)
2. Crystal growth
3. Effect of cola, coffee, etc. on teeth
4. Effect of music, video games, etc. on blood pressure
5. Strength/absorbency of paper towels (discouraged because seen often)
6. Most consumer product testing of the "Which is best?" type

7. Astrology projects
8. Maze running (unless there are variables and controls).
9. Any project that boils down to simple preferences.
10. Effect of color on taste.
11. Optical Illusions
12. Reaction Times (OK with variables and 10 per group)
13. Planaria worm regeneration (unless project has variables and >10/group)
14. Detergents vs. Stains
15. Basic solar collectors or ovens (OK if engineering design variables included)
16. Acid rain projects (To be considered, thorough research into the composition of acid rain and a scientifically accurate simulation of it would be necessary.)
17. Basic flight testing, e.g., planes, rockets (OK if variables are included)
18. Battery life comparisons (plug-in and run-down type)
19. Any project involving the distillation of alcohol. (NOT PERMITTED)
20. Pyramid power
21. Color choices of goldfish, etc.
22. Basic chromatography
23. Wing, fin shape comparison (OK if mass is taken into consideration)

Avoid Projects that Lack a Measurable Endpoint
Results should be expressed in units of growth, size, mass, speed, time, volume, frequency, replication rate, chemical product analysis, etc.

Avoid Overly Common Projects
The following projects may meet all requirements but often do not win awards because they are too commonly encountered by judges. With frequently done projects, acceptance may be granted if they have an original twist with exceptional thoroughness and solid scientific method.

1. Comparison of plant growth in different fertilizers
2. Rusting of nails in different pH solutions.
3. Comparison of strength in different bridge designs.
4. Strength of paper towels.

Projects Taken from the Internet
Projects taken directly from the Internet are considered plagiarism and may be disqualified. Judges may identify projects similar to examples posted on the internet and they will be ranked low for creativity. Examples of projects from sites such as http://www.sciencebuddies.org/ are good sources of inspiration, but the idea for your project **should be original.**

Scientific fraud and misconduct are not condoned at any level of research or competition. This includes plagiarism, forgery, use or presentation of other researcher's work as one's own and fabrication of data. Fraudulent projects will fail to qualify for

competition in SIMSEF. SIMSEF reserves the right to revoke recognition of a project subsequently found to have been fraudulent.

7. Explanations of Roles for Senior Division

The Student Researcher(s)

The student researcher is responsible for all aspects of the research project:

- Enlisting the aid of any required supervisory adults (Adult Sponsor, Qualified Scientist, etc.), obtaining necessary approvals (SRC, IRB, etc.)
- Following the International Rules & Guidelines and obtaining all necessary approvals (SRC, IRB, etc.) and completing all appropriate documentation
- Performing the project (which may include, but is not limited to) experimentation, data collection, engineering, data analysis, and any other process or procedures related to the project.
- Understanding and abiding by the Ethics Statement and attesting to this understanding on Approval Form 1B.

To avoid conflict of interest, no Adult Sponsor, parent or other relative of the student, the Qualified Scientist, or Designated Supervisor who oversees the project, may serve on the SRC or IRB reviewing that project.

The Adult Sponsor

Qualifications:

- An Adult Sponsor may be a teacher, parent, professor, and/or other professional scientist
- Should be knowledgeable in the area of student research, be familiar with the regulations around procedures and materials that apply to the student project, particularly when involving human participants, vertebrate animals, potentially hazardous biological agents or hazardous chemicals, devices or activities.
- Should have close contact with the student throughout the timeline of the project.

Responsibilities:
The Adult Sponsor is responsible for:

- Working with the student to evaluate any possible risks involved in order to ensure the health and safety of the student conducting the research and the humans and/or animals involved in the study.
- Reviewing the student's Student Checklist and Research Plan/Project Summary to ensure that:
    - experimentation follows local, state, and Federal laws and ISEF rules
    - forms are completed by other required adults any required Qualified Scientist meets the criteria as set forth in the ISEF Rules and Guidelines
    - the student's research is eligible for entry in ISEF

The Designated Supervisor (DS)

Qualifications:

- Does not need an advanced degree
- Must be familiar with the student's project and agree to any training necessary
- May also serve as the Adult Sponsor for the project

- If the project involves the use of Vertebrate Animals (where behavior/habitat is influenced by humans), must be knowledgeable about the humane care and handling of the animals

Responsibilities:

- Providing direct supervision of the student experimentation
- Completing the required documentation — the Designated Supervisor box on the Qualified Scientist Form when applicable

8. Division Project Categories

Category Number	Elementary Division Project Categories	
E01	**Behavioral Sciences**	Studies of human psychology, behavior, development, linguistics, and the effects of chemical or physical stress on these processes. Experimental or observational studies of attitudes, behaviors, or values of a society or groups within a society, and of the influences of society on group behavior. Includes gender and diversity studies, anthropology, archaeology, and sociology. Studies may focus on either normal or abnormal behavior. Senior Division only: includes studies of cognition.
E02	**Biology Animals**	Studies of vertebrate or invertebrate zoology.
E03	**Biology/Other Kingdoms**	Studies of plants, fungi, protists, and bacteria.
E04	**Chemistry**	Studies of chemical and physical properties of organic and inorganic materials.
E05	**Consumer Sciences**	Examination, comparison, analysis, and testing of manufactured devices, or trade name chemicals, materials, etc. Product quality, safety, and consumer satisfaction.
E06	**Earth Science**	Studies of geology, meteorology, oceanography, astronomy, and space science.
E07	**Engineering**	Projects that follow the Engineering Design Process to develop solutions by building and testing prototypes of new or improved devices.
E08	**Environmental Sciences**	Projects using biological systems/organisms to study the impact of natural and man-made changes in our environment.
E09	**Math**	Studies of geometry, topology, number theory, statistics, computer graphics, artificial intelligence, and modeling or stimulations.
E10	**Physics**	Studies of electricity, magnetism, aerodynamics, physical properties of matter and applied mechanics.

Category Number	Junior Division Project Categories	
J01	**Aerodynamics / Hydrodynamics** (Junior Division Only)	(Junior Division Only) Studies of aerodynamics and propulsion of air, land, water and space vehicles; aero/ hydrodynamics of structures and natural objects. Studies of the basic physics of fluid flow.
J02	**Alternative Energy** (Junior Division Only)	(Junior Division Only) Studies of power generation using alternative energy technologies such as solar cells.
J03	**Applied Mechanics & Structures**	Studies concerning the design, manufacture and operation of mechanisms, including characteristics of materials, dynamic response and active/ passive

		control. Testing for strength and stiffness of materials used to provide structural capability; studies and testing of structural configurations designed to provide improved weight and force loading or stiffness capabilities. Senior Division only: includes aerodynamics, hydrodynamics and fluids projects.
J04	**Behavioral & Social Sciences**	Studies of human psychology, behavior, development, linguistics and the effects of chemical or physical stress on these processes. Experimental or observational studies of attitudes, behaviors, or values of a society or groups within a society and of the influences of society on group behavior. Includes gender and diversity studies, anthropology, archaeology and sociology. Studies may focus on either normal or abnormal behavior?
J05	**Biochemistry/Molecular Biology**	Studies at the molecular, biochemical, or enzymatic levels in animals (including humans), plants and microorganisms, including yeast. Studies of biological molecules, e.g., DNA, RNA, proteins, fats, vitamins, nutrients.
J06	**Chemistry**	Studies in which chemical properties of nonbiological organic and inorganic materials (excluding biochemistry) are observed. Some studies involving physical properties are appropriate, including phase changes, crystal structures and formation, intermolecular and intramolecular forces.
J07	**Cognitive Science** (Junior Division Only)	Studies of learning, memory and cognition in humans, using human or animal models for human processes. Studies of the effects of chemical or physical stress on cognition. Includes projects on subliminal perception, optical illusions, recall and observations (e.g. reliability of eyewitnesses), and the interaction of different senses.
J09	**Earth & Environmental Sciences**	Projects surveying, measuring, modeling, or studying natural and man-made changes on the environment. Studies in water pollution, geology, seismology, physical oceanography, marine geology, coastal processes, air pollution, atmospheric physics and chemistry, and meteorology, including the impacts of floods, fires, acid rain, and climate change.
J10	**Electronics & Electromagnetics**	Experimental or theoretical studies with electrical circuits, computer design, electro-optics, electromagnetic applications and antennas.
J11	**Environmental Engineering**	Projects which apply technologies such as recycling, reclamation, restoration, composting and bioremediation which could benefit the environment and/or the effects of pollution on the environment.
J12	**Mammalian Biology**	Studies of growth and developmental biology, anatomy and physiology in all mammals, including humans. Studies of the behavior of all mammals in their natural habitats (or reproductions of them).
J13	**Material Sciences** (Junior Division Only)	(Junior Division Only) Studies of materials characteristics and their static (not in motion) physical properties. Includes measurements and comparisons of materials durability, flammability and insulation properties (thermal, electrical, acoustic, optical, electromagnetic, etc.).
J14	**Mathematical Sciences**	Studies of mathematics (e.g., algebra, geometry, logic), and computer science (e.g., artificial intelligence, and the design, improvement, or optimization of algorithms, computer languages, operating systems, or software architecture.)
J16	**Microbiology-Medical** (Junior Division Only)	(Junior Division Only) Studies of prevention, diagnosis and treatment of infectious diseases caused by pathogenic bacteria, fungi, or viruses. Includes all antimicrobial studies except testing of commercial antimicrobials.
J17	**Physics & Astronomy**	Studies of the physical properties of matter, light, acoustics, thermal properties, solar physics, astrophysics, orbital mechanics, observational astronomy, planetary

		science and astronomical surveys. Computer simulations of physical systems are appropriate in this category.
J18	**Plant Biology**	Studies of the genetics, growth, morphology, or physiology of plants. Studies of the effects of fertilizers on plants.
J19	**Product Science-Biological** (Junior Division Only)	(Junior Division Only) Comparison and testing of commercial off-the-shelf products for quality and/or effectiveness for intended use in real-world consumer-oriented applications. This category is reserved for experimental methods involving biological sciences and processes.
J20	**Product Science-Physical** (Junior Division Only)	(Junior Division Only) Comparison and testing of commercial off-the-shelf products for quality and/or effectiveness for intended use in real-world consumer-oriented applications. This category is reserved for experimental methods involving non-biological, physical sciences and processes.
J21	**Toxicology**	Studies of the effects of the negative effects of chemicals, toxins, medicinal and nutritional factors, prescription drugs, natural remedies, food components (caffeine) and other potentially harmful factors (such as temperature, carbon dioxide, radiation) at the cellular or higher levels on plants and animals.
J22	**Zoology**	Studies of growth and developmental biology, anatomy and physiology in animals other than mammals. Studies of the behavior of all animals (excluding mammals) in their natural habitats (or reproductions of them).

Category Number	**Senior Division Project Categories**	
S03	**Applied Mechanics & Structures**	Studies concerning the design, manufacture and operation of mechanisms, including characteristics of materials, dynamic response and active/ passive control. Testing for strength and stiffness of materials used to provide structural capability; studies and testing of structural configurations designed to provide improved weight and force loading or stiffness capabilities. Senior Division only: includes aerodynamics, hydrodynamics and fluids projects.
S04	**Behavioral & Social Sciences**	Studies of human psychology, behavior, development, linguistics and the effects of chemical or physical stress on these processes. Experimental or observational studies of attitudes, behaviors, or values of a society or groups within a society and of the influences of society on group behavior. Includes gender and diversity studies, anthropology, archaeology and sociology. Studies may focus on either normal or abnormal behavior?
S05	**Biochemistry/Molecular Biology**	Studies at the molecular, biochemical, or enzymatic levels in animals (including humans), plants and microorganisms, including yeast. Studies of biological molecules, e.g., DNA, RNA, proteins, fats, vitamins, nutrients.
S06	**Chemistry**	Studies in which chemical properties of nonbiological organic and inorganic materials (excluding biochemistry) are observed. Some studies involving physical properties are appropriate, including phase changes, crystal structures and formation, intermolecular and intramolecular forces.
S08	**Computational Systems & Analysis** (Senior Division Only)	(Senior Division Only): Studies that focus primarily on the development or use of computational systems for applications in the biological, physical, or engineering sciences, such as analyzing big data, modeling and simulations, autonomous navigation, and bioinformatics.

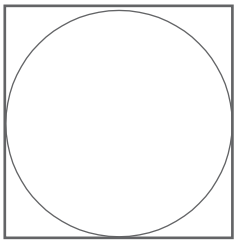
S09	**Earth & Environmental Sciences**	Projects surveying, measuring, modeling, or studying natural and man-made changes on the environment. Studies in water pollution, geology, seismology, physical oceanography, marine geology, coastal processes, air pollution, atmospheric physics and chemistry, and meteorology, including the impacts of floods, fires, acid rain, and climate change.
S10	**Electronics & Electromagnetics**	Experimental or theoretical studies with electrical circuits, computer design, electro-optics, electromagnetic applications and antennas.
S11	**Environmental Engineering**	Projects which apply technologies such as recycling, reclamation, restoration, composting and bioremediation which could benefit the environment and/or the effects of pollution on the environment.
S12	**Mammalian Biology**	Studies of growth and developmental biology, anatomy and physiology in all mammals, including humans. Studies of the behavior of all mammals in their natural habitats (or reproductions of them).
S14	**Mathematical Sciences**	Studies of mathematics (e.g., algebra, geometry, logic), and computer science (e.g., artificial intelligence, and the design, improvement, or optimization of algorithms, computer languages, operating systems, or software architecture.)
S15	**Microbiology-General** (Senior Division Only)	(Senior Division Only): Studies of genetics, growth and physiology of bacteria, fungi, protists, algae, or viruses. Includes surveys of bacterial contamination Includes projects described within the category Microbiology (Medical).
S17	**Physics & Astronomy**	Studies of the physical properties of matter, light, acoustics, thermal properties, solar physics, astrophysics, orbital mechanics, observational astronomy, planetary science and astronomical surveys. Computer simulations of physical systems are appropriate in this category.
S18	**Plant Biology**	Studies of the genetics, growth, morphology, or physiology of plants. Studies of the effects of fertilizers on plants.
J21	**Toxicology**	Studies of the effects of the negative effects of chemicals, toxins, medicinal and nutritional factors, prescription drugs, natural remedies, food components (caffeine) and other potentially harmful factors (such as temperature, carbon dioxide, radiation) at the cellular or higher levels on plants and animals.
J22	**Zoology**	Studies of growth and developmental biology, anatomy and physiology in animals other than mammals. Studies of the behavior of all animals (excluding mammals) in their natural habitats (or reproductions of them).

9. Examples of Abstract, Quad Chart, and Backboard

Abstract 2023-2024

Project Title	**Category Selection** **Mark an "X" for your category selection.**
Student Name(s)	
Team Member Name(s) 1.	
2.	
3.	
District Name	
School Name	
Teacher Name	
Grade Level	
Abstract **Your abstract should be written after you finish the research and experimentation and should include:** 500 words or less (to fit on one page) Purpose of the project Hypothesis or evaluation criteria Brief statement about procedures and equipment Results (analysis of data) Conclusions	

	Animal Sciences
	Behavioral and Social Sciences
	Biochemistry
	Cellular and Molecular Biology
	Chemistry
	Computational Biology and Bioinformatics
	Earth and Planetary Sciences
	Embedded Systems
	Engineering, Electrical & Mechanical
	Engineering, Energy & Transport
	Engineering, Materials & Bioengineering
	Environmental Sciences & Management
	Health & Medical Sciences
	Mathematics
	Microbiology
	Physics and Astronomy
	Plant Sciences
	Robotics and Intelligent Machines
	Systems Software



1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

O Human participants O Potentially hazardous biological agents
O Vertebrate animals. O Microorganisms O DNA O Tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only. ☐ YES ☐ NO

3. I/We worked or used equipment in a regulated research institution or industrial setting. ☐ YES ☐ NO

4. This project is a continuation of previous research. ☐ YES ☐ NO

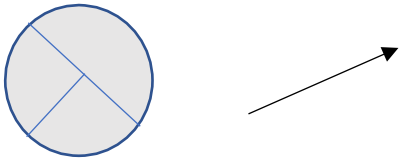
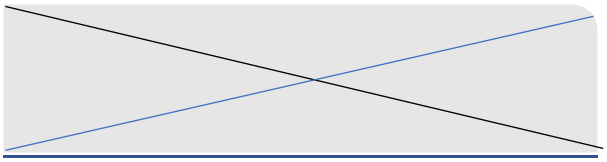
5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ YES ☐ NO

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work. ☐ YES ☐ NO

Quad Chart Instructions

A "quad chart" is a single page divided into four quadrants providing a high-level summary of the project. It is intended to be more visual than detailed in order to quickly introduce your judges to what is important about your project. Follow the model below that corresponds to the Project Presentation template you selected.

1. You must use a page size no larger than either American standard 8½"X11" or European standard A4.
2. The page background color must be white.
3. Text color must be predominantly black, but limited color for emphasis is acceptable.
4. The minimum allowable font size is 14 pt. *Exception*: You may use a smaller font size, down to 10 pt., for figure captions or photo credits.
5. All four quadrants of your Quad Chart should each be the same size with a single border line delimiting each, as in the examples below. The Title section should be only as tall as necessary to include your project title and other identifying information (see section on Quad Chart Title).
6. The Quad Chart should not include a bibliography, references, or acknowledgments.

Science Project Quad Chart	
Q1: Research Question • • • •	Q3: Data Analysis & Results 
Q2: Methodology • • • • • •	Q4: Interpretation & Conclusions • • • 

Engineering Project Quad Chart	
Q1: Engineering Problem & Project Objectives	Q3: Data Analysis & Results
Q2: Project Design	Q4: Interpretation & Conclusions

Quad Chart Title:

- Line one is the title of your project and Project Number
- Line two is your name, school, city, state, county

Quadrant 1: Research Question/Engineering Goal

- This should be a summary of material in #2 of the Project Presentation Template.
- Please state the research question or engineering problem being addressed
- A leading core graphic or visual is encouraged, but not required.

Quadrant 2: Methodology/Project Design

- This should be a summary of material in #3 of the Project Presentation Template.
- Please provide a succinct, bulleted summary of the methodology/project design

Quadrant 3: Data Analysis & Results

- This should be a summary of material in #4 and #5 of the Project Presentation Template.
- It is advised that this quadrant should primarily be a graphic representation of relevant data and results.
- Text should be kept to a minimum.

Quadrant 4: Interpretation & Conclusions

- This should be a summary of material in #5 and #6 of the Project Presentation Template.

Quad Chart Guidelines and sample link

QUAD CHART TEMPLATE: GENERAL SCIENCE PROJECT

<table>
<tr><th colspan="2">[PROJECT TITLE] – [PROJECT ID Number]</th></tr>
<tr><td>Q1: INTRODUCTION – What is your research question?

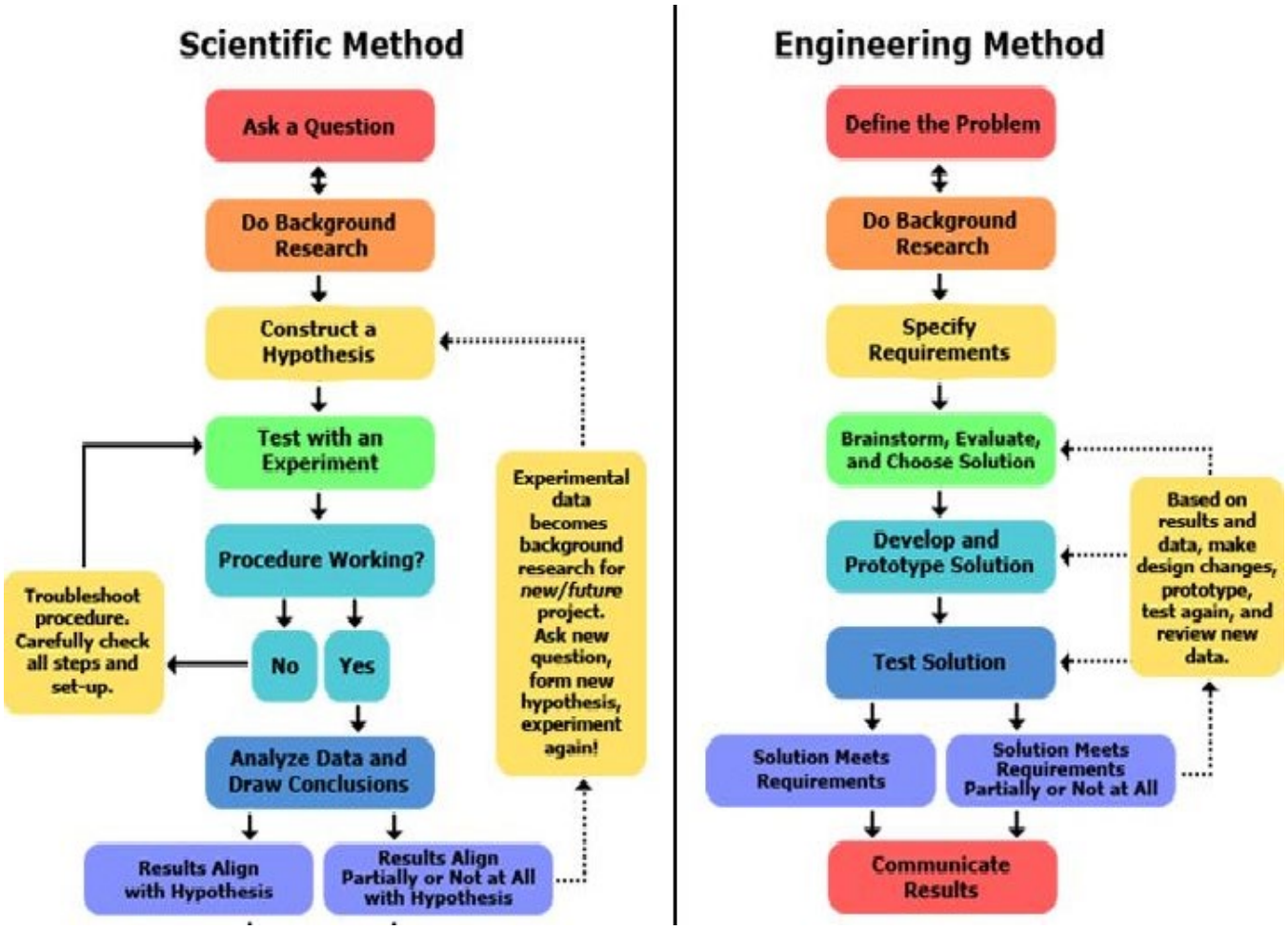
• Explain what is known or has already been done in your research area. Include a brief review of relevant literature.
• If applicable: If this is a continuation project, a brief summary of your prior research is appropriate here. Be sure to distinguish your previous work from this year's project.
• What were you trying to find out? Include a description of your purpose, your research question, and/or your hypothesis.

IMAGES / Data</td><td>Q3: Data Analysis & Results – What were the result(s) of your project?

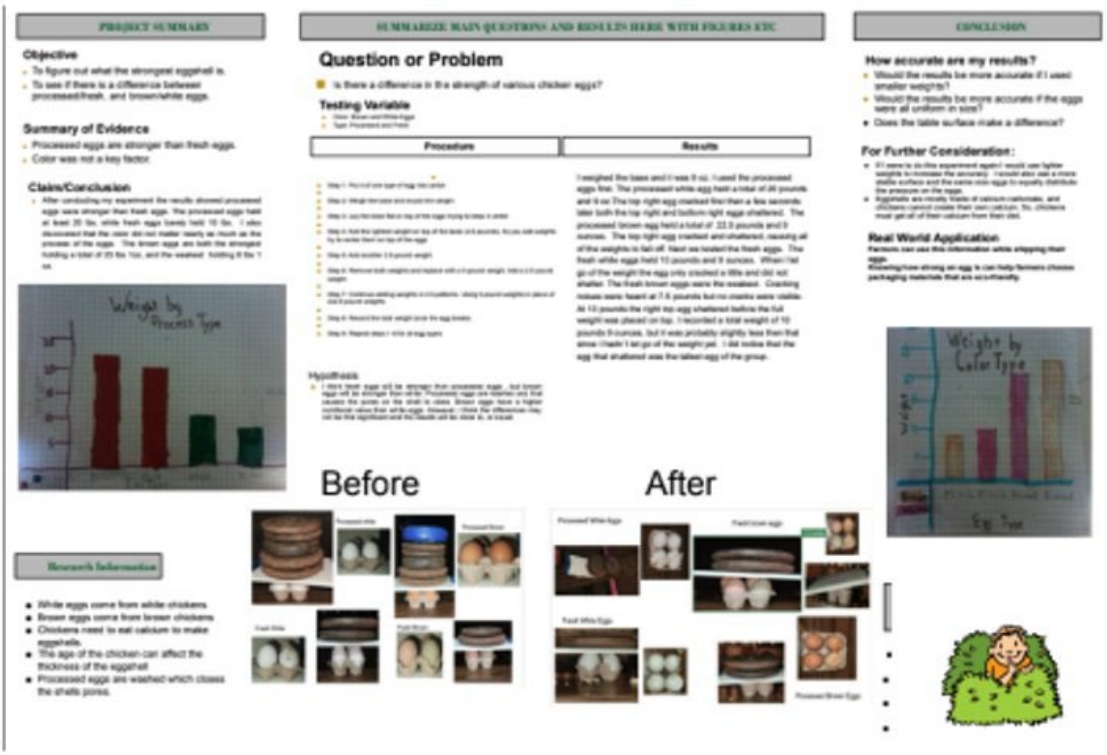
• Include tables and figures which illustrate your data.
• Include relevant statistical analysis of the data.

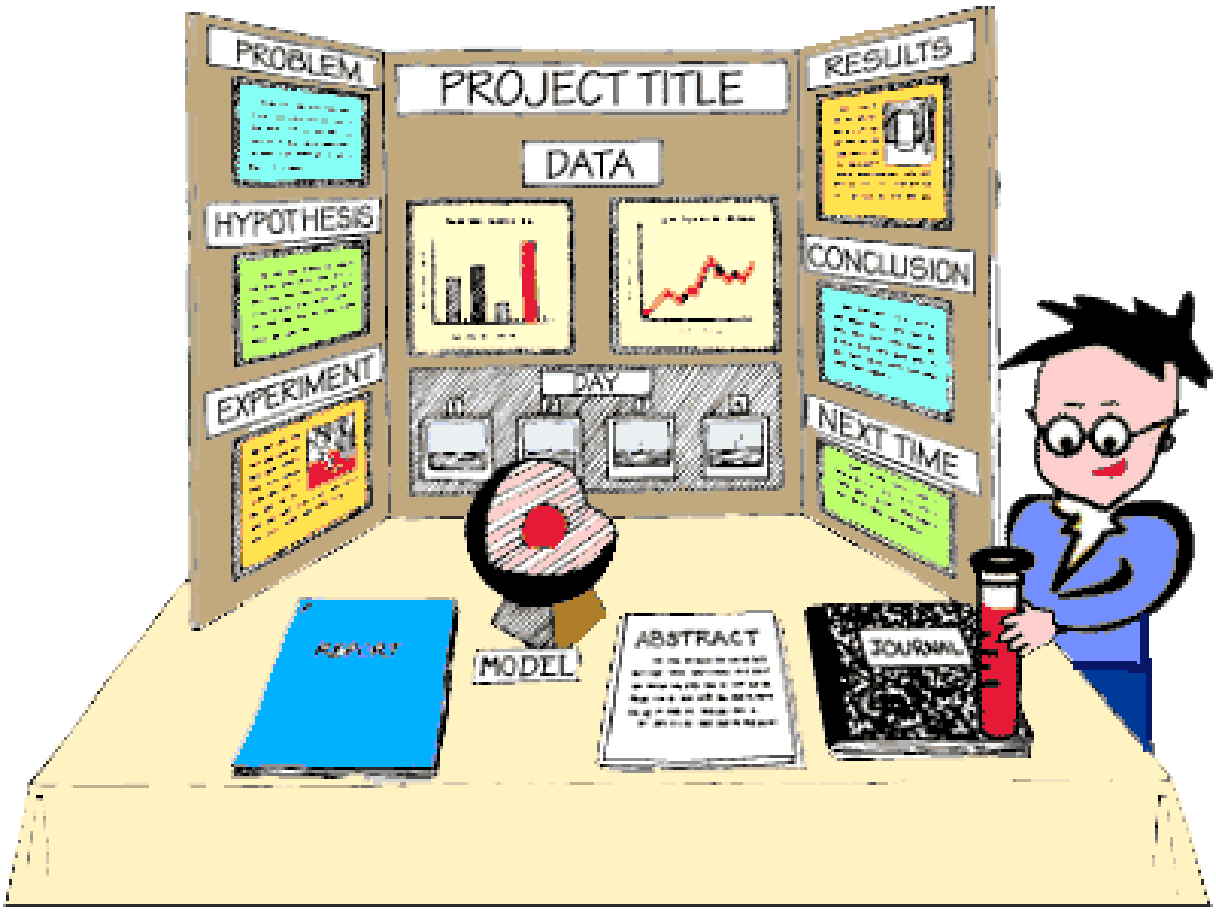
Images / data</td></tr>
<tr><td>Q2: Methodology – Explain your methodology and procedures for carrying out your project in detail.

• What did you do?
• What data did you collect and how did you collect that data?
• Discuss your control group and the variables you tested.
• DO NOT include a list of materials.</td><td>Q4: Discussion – What is your interpretation of these results?
• What do these results mean? Compare your results with theories, published data, commonly held beliefs, and expected results.
• Discuss possible errors. Did any questions or problems arise that you were not expecting? How did the data vary between repeated observations of similar events? How were results affected by uncontrolled events?
Q4: Conclusions – What conclusions did you reach?
• What do these results mean in the context of the literature review and other work being done in your research area? How do the results address your research question? Do your results support your hypothesis?
• What application(s) do you see for your work?</td></tr>
</table>


Scientific Method
Ask a Question
Do Background Research
Construct a Hypothesis
Test with an Experiment
Procedure Working?
No
Yes
Troubleshoot procedure. Carefully check all steps and set-up.
Analyze Data and Draw Conclusions
Results Align with Hypothesis
Results Align Partially or Not at All with Hypothesis
Experimental data becomes background research for new/future project. Ask new question, form new hypothesis, experiment again!
Engineering Method
Define the Problem
Do Background Research
Specify Requirements
Brainstorm, Evaluate, and Choose Solution
Develop and Prototype Solution
Test Solution
Solution Meets Requirements
Solution Meets Requirements Partially or Not at All
Based on results and data, make design changes, prototype, test again, and review new data.
Communicate Results

SAMPLE 1 - Individual 4th/5th Grade Project - Digital Display





Engineering Project Backboard Sample