# Chino Valley Unified School District
# Science and Engineering Fair Handbook
# 2022-2023

## Key Points

**Read & review – The Rules Wizard** and the ISEF 2022-2023 Rules & Regulations

**Team Projects - Team projects may have up to 3 team members.**
Each member of the team must complete registration on zFairs. Each project must have the same exact project title and same copy of the abstract uploaded. Team projects will need to be linked to reflect the same project ID number as their team members.

**All Projects -** Please do not include pictures with faces. If they are in the picture, please cover or distort the student/adult face.

**Project Title -** Do not abbreviate unless necessary. Please avoid extremely long titles. Your title must be the same as it will appear on your display at the CVUSD Science & Engineering Fair.

**Display requirements – The CVUSD Science & Engineering Fair for 2022-2023 is in person.**
**Grades 4-5:**

- **Complete the online Chino zFairs registration**
- **Submit EZ form**
- **Create and upload a virtual Quad Chart or Display Board (in pdf format)**
- **Upload a PowerPoint or Google slide presentation**
- **Upload a video (3 min. max) presentation to introduce themselves and their project**

**Grades 6-12:**

- **Complete the online Chino zFairs registration**
- **Submit all necessary forms**
- **Create and upload a virtual Quad Chart or Display Board**
- **Upload a PowerPoint or Google slide presentation**
- **Upload a video (3 min. max) presentation to introduce themselves and their project**
- **Abstract**

**Certifications/Forms -** If your project involves the use of human or animal tissue(s) (including blood), live vertebrate animals, or human subjects, complete the appropriate pre-approval forms and requirements, upload with online registration, and submit to steve_buss@chino.k12.ca.us and curt_sumners@chino.k12.ca.us before starting project or December 1, 2022, at the latest. Resources: The Rules Wizard and ISEF 2022-2023 Rules & Regulations. **NO EXCEPTIONS**

## Ethics Statement

Student researchers, as well as adults who have a role in their projects, are expected to maintain the highest ethical standards. These standards include, but are not limited to:

- **Integrity.** Honesty, objectivity, and avoidance of conflicts of interest are expected during every phase of the project. The project should reflect independent research done by the student(s) and be free of fraudulent data and/or plagiarism and represent only one year's work.
- **Legality.** Compliance with all federal, state and local laws and regulations is essential. In addition, projects conducted outside the U.S. must also adhere to the laws of the country and jurisdiction in which the project was performed. All projects must be approved by a Scientific Review Committee (SRC), and when necessary, must also be approved by an Institutional Review Board (IRB), Institutional Animal Care and Use Committee (IACUC), and/or Institutional Biosafety Committee (IBC). Native, genetically altered, and/or invasive species, (e.g. insects, plants, invertebrates, vertebrates), pathogens, toxic chemicals or foreign substances reintroduced into the environment is prohibited. It is recommended that students reference their local, state or national laws and regulations.
- **Respect for Confidentiality and Intellectual Property**. Confidential communications, as well as patents, copyrights, and other forms of intellectual property must be honored. Unpublished data, methods, or results may not be used without permission, and credit must be given for all contributions to the research.
- **Stewardship of the Environment.** It is the responsibility of the researcher and the adults involved to protect the environment from harm. Introduction or disposal of native, genetically altered, and/or invasive species, (e.g. insects, plants, invertebrates, vertebrates), pathogens, toxic chemicals or foreign substances into the environment is prohibited. It is recommended that students reference their local, state or national regulations and quarantine lists.
- **Acknowledgment of Risks.** All projects involve some amount of risk. Everyone is expected to recognize the hazards, assess the risks, minimize the risks, and prepare for emergencies.
- **Animal Care.** Proper care and respect must be given to vertebrate animals. The use of non-animal research methods and alternatives to animal research are strongly encouraged and must be explored before conducting a vertebrate animal project. The guiding principles for the use of animals in research includes the following "Four R's:' Replace, Reduce, Refine, Respect.
- **Human Participant Protection.** The highest priority is the health and well-being of the student researcher(s) and human participants.
- **Potentially Hazardous Biological Agents (PHBAs)**. It is the responsibility of the student and adults involved in the project to conduct and document a risk assessment, and to safely handle and dispose of organisms and materials.
- **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 affiliated fairs and ISEF. Society for Science and the Public reserves the right to revoke recognition of a project subsequently found to have been fraudulent.

# Table of Contents

## For Coordinators/Teachers



## For Students

# Minimum Quality Standards

## Types of Science Fair Projects:

**Science Project:** investigates the effects of changes or answers the question "Why?" using 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 formation of logical conclusions).

**Engineering Project:** The project has a clear objective relevant to the needs of the potential user. The product, or process, has been tested and is both workable and feasible economically and ecologically. It solves a need, or problem, and includes measurements of success.

**Mathematics and Computer Project:** The project has a clear objective and has been thoroughly tested and the process is well documented to both practical and workable outcome(s).

**Demonstration Project:** shows how something works [NOT accepted at the fair].

**Science Inquiry Project - Minimum Requirements**

1. Researcher defines a testable question that begins with "Why… or What is effect of a change in X on Y? (for example, What is the effect of a change in the river current flow rate on salmon migration and spawning rates?).
2. Bibliography includes references from your literature research.
3. Hypothesis is based on library research and knowledge. The hypothesis is the researcher's best estimate of what will happen.
4. Experimental design
    - Describe and set up a control (a "standard" group) to which all test groups will be compared.
    - Describe the test groups where only one variable in each test group differs from the "control" group. Each test group can use a different test variable such as a different % test solution per group. Each variable should be decided upon using good logic.
    - Describe the measurable endpoint(s). The endpoints (or outcomes), determined for each test group, are the quantitative measurements required by the objectives.
    - Each test group should contain a minimum of 10 of the same type of objects being tested (seeds, plants, worms, etc.). A group size of *at least* 20 is required for projects with human participants.
    - Plan to change only one variable in each test cycle (trial). However, change the variable in several ways several concentrations of a chemical (1%, 3%, etc.), several temperatures, or several time points (5 minutes, 10 minutes, etc.).
    - Quantitative data (numerical) only. Not qualitative (descriptions e.g. color, smell etc.).
    - Report measurements in metric units when possible.
    - Repeat the test a minimum of 5 times to see if your results are reproducible.

## Engineering Project - Minimum Requirements

1. Clearly define the problem or need the engineering project will solve.
2. Establish criteria and design constraints
    - Physical and functional characteristics of the design (shape, weight, etc.).
    - Design constraints/limitations (cost, time, available materials, etc.).
3. Research, evaluate alternatives, test plan
4. Construct a prototype or computer model etc.
5. Test against established criteria
6. Failure analysis, tweak, and re-test as many times as possible
7. Final documentation
8. Include bibliography from your literature research.

## Product Testing Project *[Grades 4 - 5 only] *not allowed for grade 6 and above*

1. Clearly identify what kind of item (candles, hair products, etc.) you plan to test.
2. Define a test group of at least five (5) similar items
3. Include test criteria that:
   *Defines what will be measured.
   *Describes how you will take measurements.
   *Define criteria for changing qualitative measurements into quantitative measurements. Such as "on a scale of 10 = (cleanest is 10, moderately clean is 8, less than moderately clean is 6, not clean at all is 1.).
   An important first step in qualitative analysis and observer impression is to discover patterns. Try to find frequencies, magnitudes, structures, processes, causes, and consequences which can be changed to numerical data.
   *Report measurements in metric units, when possible.
   *Repeat the testing a minimum of 10+ times to see if the results are reproducible.

## Demonstration Projects

**Demonstration Projects are NOT accepted at the science fair** because they only show or explain how something works. **However** - think about what interests you about your demonstration project?
Can you channel your interest into a Science, Engineering, Human Subjects or Product Testing project? **For instance,** if you were planning to build a robot from a kit that when built according to the directions will be able to bounce a ball - You could change it up by building the robot BUT reprogram it so instead of bouncing a ball it does something else not intended by the kit.
Ask your teacher or adult mentor for help in converting a demonstration project into a science or engineering project.

# CVUSD Project Display Information

If there are any questions regarding Display & Safety Regulations, please contact steve_buss@chino.k12.ca.us or curt_sumners@chino.k12.ca.us .

## REQUIRED Items:

*I. Forms needed to compete at the county SIMSEF must be completed prior to competing in the CVUSD Science Fair*

Grades 4-5:

a. ISEF Rules Wizard needs to be completed prior to starting project to determine if the project needs to be reviewed by the district/county Scientific Review Committee prior to starting
b. EZ Form
c. Form R – Research Plan/Project Summary Form [if required]

Grades 6-12:

a. ISEF Rules Wizard needs to be completed prior to starting project to determine if the project needs to be reviewed by the district/county Scientific Review Committee prior to starting
b. Official Abstract (250 words)
c. Form 1A – Student Checklist – Research Plan Instructions
d. Form 1B – Student/Parent Approval
e. Form R – Research Plan/Project Summary Form [if required]
f. SIMSEF Student Signature Card (needed as a trophy winner at district level only)

*II. Project Presentation*

a. The project presentation is in addition to the project backboard used during in-person fairs. Please see the complete instructions of the format requirements and recommendations on page 14.
b. There are three suggested templates based on project type:
    i. Science Projects,
    ii. Engineering Projects and
    iii. Mathematics/Computer Science Projects.

*III. A Quad Chart (or .pdf of the actual backboard)*

a. The quad chart summarizes the project in a single page for a quick overview by the judges.
b. Please see complete instructions with format requirements and recommendations, as well as sample templates on page 14.

*IV. Abstract (Grades 6-12 only)*

a. 250 word maximum
b. Should include: purpose, procedure, data, conclusions

## V. *Project Video (3 minute maximum)*

a. This video summarizes the project for the judges.
b. Please see pages 14 and 21 for video guidelines and suggestions.

## VI. *Research*

This page represents research conducted by the student(s) about the Science Project topic. The research is designed to help students better become experts at explaining why their hypotheses are true or false. Research should be from valid sources. Students should compare multiple texts to validate accuracy of information. *(See CCSS ELA RI4.8 and RI 4.9; RI 5.8 and RI 5.9; and RI 6.7 and 6.8)*

The information should be in the students' own words. Here are some examples of how the Science Topic is connected to the research conducted.

| **Science Fair Topic** | **Research** |
|---|---|
| What is the best light source for plants to grow? | Research what plants need to grow; the photosynthesis process. |
| What materials are best to keep people cool? | Research heat absorption or reflection of different colors and fabrics. |
| What fruit makes the best conductor of electricity? | Research how the fruit's structure helps it be a conductor. How electricity travels through different substances. |
| Does salt water heat up quicker than non-salt water? | Research solutions and the properties of solutions; how salt affects temperature. |

Students may conduct research through: Internet, books, interviews, etc… The research should be related to your experiment topic as illustrated above. The research should be accompanied by a bibliography of sources used.

**(*Note: Do Not place articles and print outs from Internet Web pages in your research. Students need* to read those items and synthesize the information into their own words.)**

### *VII. Lab Notebook Image/Journal*

The science journal should include the data you collected while conducting the experiment. It should include dates and times you performed each of the steps in your experiment. **All measurements should be recorded in metric form (millimeters, centimeters, liters etc**.)

The journal/notebook should include drawings, diagrams, designs, etc. used to organize your experiment. A photo could be uploaded as an image of the journal.

## *Audio Visual Presentations/Photographs*

Any photograph/visual image/chart/table and/or graph is allowed if:

1. It is not deemed offensive or inappropriate. The decision made is final.
2. It has a credit line of origin ("Photograph taken by…" or "Image taken from…" or "Graph/Chart/Table taken from…"). (If all images, etc. being displayed were taken or created by the student or are from the same source, one credit line prominently and vertically displayed is sufficient.)
3. It is from the Internet, magazine, newspaper, journal, etc., and a credit line is attached. (If all photographs, etc. are from the same source, one credit prominently and displayed is sufficient.)
4. It is a photograph or visual depiction that does not provide any public disclosure or identifying information of human subjects, regardless of the method or modality of that public disclosure (i.e., pictures, videos, etc.). Human participants and the project researcher must have their faces covered.

## *Items/Materials Not Allowed on Quad Chart/Display Board*

Any items that are acknowledgements, self-promotions or external endorsements *(such as naming the research institution, mentor or patent pending statements)* and/or are intended for distribution including:

1. The use of logos including known commercial brands, institutional crests or trademarks, unless integral to the project and approved by CVUSD.
2. Personalized graphic/logo that is developed to indicate a commercial purpose or viability of an established or proposed business associated with the project, unless student-created in which it can be displayed on the board only once.
3. Any reference to an institution or mentor that supported research except as provided in the official paperwork.
4. Any reference to patent status of the project.
5. Postal addresses, World Wide Web, email and/or social media addresses, QR codes, telephone and/or fax numbers of a project or student.
6. Awards won in previous competitions.
7. Active Internet or email connections as part of displaying or operating the project.

## *Other Regulations*

1. It is highly recommended that your name, school, grade, and district be placed on all digital notebooks or materials that are part with your project.
2. CVUSD reserves the right to Fail to Qualify FTQ any project for safety reasons or to protect the integrity of the science fair and its rules and regulations.

## PowerPoint Presentation Instructions

You may prepare your presentation using any software tools that you desire, but the final document submitted for display to the judges and the public must satisfy the following requirements.

### Format Requirements

1. The Project Presentation must be a single PDF document limited to no more than 12 pages.
2. You must use a page size no larger than either American standard 8½"X11" or European standard A4.
3. The PDF document must open with default magnification "Fit Page" so that **the entire page is visible at the same time**. Recognizing that almost all judges will view your presentation on screens that are wider than they are tall, you should create all pages in Landscape mode.
4. Your PDF document must not have instructions to open in "full screen mode." Eliminating this mode automatically precludes page transitions and embedded videos or animations, so do not attempt to include these in your Presentation. (There is provision elsewhere in your submission for an optional video if you need something to move in order to illustrate your project.)
5. The page background color must be white.
6. Text color must be predominantly black, but limited color for emphasis is acceptable.
7. All text should be readable easily when viewing the entire page at once. The smallest allowable font size of body text is 14 pt. *Exception:* You may use a smaller font size, down to 10 pt., for figure captions or photo credits.
8. All Project Presentation elements must conform to D&S rules as if placed on a physical poster for display to judges and the public. Passing a Display & Safety inspection will be required to compete.

### Format Recommendations:

1. Do not use non-standard fonts or colors to "stand out from the crowd" or to be entertaining. It is recommended that you use a font such as Arial, Calibri, Helvetica or Century Gothic.
2. Page titles should all be the same size. That size should be larger than headings within each page. In turn, headings should be larger than body text. For readability, we recommend body text be no smaller than 18 pt.
3. Avoid long expository paragraphs. State your points succinctly.
4. Use bullets to set out individual points of interest. Use numbered lists when the ordering of points of interest is important (*e.g.*, instructions to be followed in order, or items needing a reference anchor for citation elsewhere in your Presentation).
5. All body text should adopt a common font style and size. Similarly, all heading text should adopt a common font style and size. There is no recommendation for the style and size relation between body and heading text.

## Project Presentation Templates

Choose one of the following templates to create your presentation. Do not include information not specified in this template. If you are submitting a continuation project, include only information related to this year's research unless otherwise directed in the instructions below. You may include graphical elements as they would explain or illustrate your work and can be contained within the overall page limits.

Each of the seven (7) required sections in each template must start on its own page. Each section may use as many pages as you want, as long as all formatting instructions above (such as page count) are satisfied.

TEMPLATE I: Science Projects
TEMPLATE II: Engineering Projects
TEMPLATEIII: Mathematics/Computer Science Projects *(being developed)*

# Project Presentation Template: **Science Project**

1. **Project ID and Title**
   - The following should be included:
     - Project Title
     - Finalist Name (s)
     - School(s)
     - City, State, Province, Country
2. **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 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.

3. **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.

4. **What were the result(s) of your project?**
   - Include tables and figures which illustrate your data.
   - Include relevant statistical analysis of the data.

5. **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?

6. **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?

7. **References**
   - This section should not exceed one page. Limit your list to the most important references.
   - List the references/documentation used which were not of your own creation (i.e., books, journal articles).

# Project Presentation Template: **Engineering Project**

1. **Project ID and Title**
   - The following should be included:
     - Project Title
     - Finalist Name (s)
     - School(s)
     - City, State, Province, Country
2. **What is your engineering problem and goal?**
   - What problem were you trying to solve? Include a description of your engineering goal.
   - Explain what is known or has already been done to solve this problem, including work on which you may build. You may include a brief review of relevant literature.
   - If this is a continuation project, a brief summary of your prior work is appropriate here. Be sure to distinguish your previous work from this year's project.

3. **Explain your methods and procedures for building your design.**
   - What did you do? How did you design and produce your prototype? If there is a physical prototype, you may want to include pictures or designs of the prototype.
   - If you tested the prototype, what were your testing procedures? What data did you collect and how did you collect that data?
   - DO NOT include a separate list of materials.

4. **What were the result(s) of your project?**
   - How did your prototype meet your engineering goal?
   - If you tested the prototype, provide a summary of testing data tables and figures that illustrate your results.
   - Include relevant statistical analysis of the data.

5. **What is your interpretation of these results?**
   - What do these results mean? You may compare your results with theories, published data, commonly held beliefs, and/or expected results.
   - Did any questions or problems arise that you were not expecting? Were these problems caused by uncontrolled events? How did you address these?
   - How is your prototype an improvement or advancement over what is currently available?

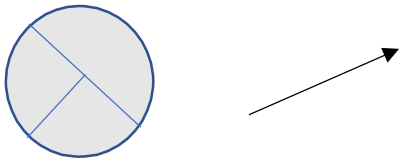
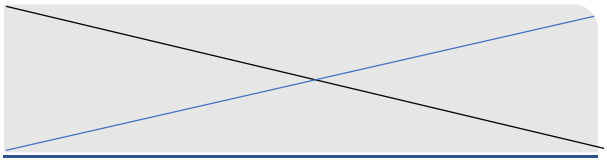
6. **What conclusions did you reach?**
   - Did your project turn out as you expected?
   - What application(s) do you see for your work?

7. **References**
   - This section should not exceed one page. Limit your list to the most important references.
   - List the references/documentation used which were not of your own creation (i.e., books, journal articles).

# 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<br>• <br>• <br>• <br>• | Q3: Data Analysis & Results<br>  |
| Q2: Methodology<br>• <br>• <br>• <br>• <br>• <br>• | Q4: Interpretation & Conclusions<br>• <br>• <br>• <br>  |

| **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, country

### *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

# Project Video Instructions

Record a video (maximum duration 3 minutes) explaining your project. The target audience for this video is both judges and the general public. It should give an overview of what the project is about and what you learned.

## *What to include in your video:*

**1. Introduce Yourself:** State your full name and your city/state/country. Rather than reciting your project title, consider explaining your project in a single sentence.

2. **Explain Your Project:** Summarize your research into main points:
   a. What did you do?
   b. What did you find?
   c. What conclusions did you draw?

**To note:**

- You can use any props or visuals you may have that are within the Display & Safety guidelines.
- Do not include anyone in your video other than the student researchers of the project.

## *Best Practices for Filming:*

These videos will not be edited. To ensure your video is the best representation of your work, please keep these best practices in mind while filming:

- Please speak in English.
- Film yourself in a well-lit and non-distracting environment so the viewer's focus stays on you and your work.
- For best results, film your video horizontally (landscape).
- Keep the camera still and in place during filming.
- Speak clearly and loudly enough that the recording is able to pick up every word you say.
- Avoid long pauses.
- Listen to your video after recording to ensure your voice is clear and audible, and that the video has not picked up too much background noise.
- Make sure that when uploading your video that you use a private YouTube channel or Google Drive and allow access for all viewers.

# GROUNDS FOR IMMEDIATE DISQUALIFICATIONS

**CVUSD will follow the International Rules and Regulations for the Society for Science including submitting proposals, uploading forms with appropriate signatures and are expected to maintain the highest ethical standards of rules for Vertebrae Animals, Human Participants, Potentially Hazardous Biological Agents, Hazardous Chemicals Activities, and Devices.**

## *Tobacco, Alcohol and Controlled Substances*

1. No project may use consumable tobacco, alcohol or legally/illegally obtained narcotics and/or controlled substances. This includes surveys that compare the use of the above substances (e.g., smokers vs. non-smokers).
2. Controlled substances (drugs, chemicals, anesthetics, etc., the use of which is regulated by the Comprehensive Drug Abuse Prevention and Control Act of 1970) must conform to existing local, state, and federal laws. Such substances may not be exhibited or used as a research project due to Ed Code Violation.
3. Students are prohibited from administering prescription drugs to human participants.
4. A veterinarian must supervise student administration of any prescription drugs to vertebrate animals.

## *Chemicals*

1. Projects that use a chemical with a hazard rating of five or with asterisks are not permitted.
2. For help on chemical use, use The Science Safety Handbook for California Public Schools (2014 edition) downloadable at: www.cde.ca.gov/pd/ca/sc/documents/scisafebook2014.pdf.
3. Projects that use a chemical with a hazard rating of five or with asterisks are not permitted. For help on chemical use, use The Science Safety Handbook for California Public Schools (2014 edition) downloadable at: www.cde.ca.gov/pd/ca/sc/documents/scisafebook2014.pdf.

## *Firearms, Explosives and Projectiles*

1. Fire regulations prohibit the use of highly flammable or combustible materials in project displays. Education Code, Section 48915. “Firearm” means any device designed to be used as a weapon from which a projectile is expelled through a barrel by the force of any explosion or other form of combustion. Examples of dangerous objects include but are not limited to: airsoft guns, paintball guns, BB guns, pellet guns, air rifles, brass knuckles, fist packs, nunchaku, slingshots, throwing stars, darts, and any object likely to cause injury to person or property that has no reasonable use at school. Education Code 48900(b).
2. Projects involving the discharge of a single or multiple projectile by mechanical, chemical or electromagnetic means are not permitted. Examples: archery, tackle, air guns, firearms of any type, etc.
3. Regarding rocket propelled projectiles, only commercially produced Class A or smaller engines are permitted.
4. The length of the rocket must not measure less than 10 inches (25 cm) or more than 15 inches (38 cm).
5. The minimum size of the launch site for class A or similar engines should extend to a radius of 100 feet (30 m) from the firing position.
6. Application for a special launch permit may be required by local fire protection agencies.
7. Designated supervisors and/or teachers should caution their students about the dangers of experimenting with rockets and missiles, especially the dangers in the preparation and use of noncommercial rockets and propellants.
8. Teachers must refrain from the following practices:
    1. Providing chemicals for rockets or missiles or helping students to obtain them.

2. Using, or permitting to be used, liquid or solid fuels in the classroom (such use essentially constitutes a controlled explosion).
3. Permitting the construction of rockets, missiles, or component parts in the classroom or shop.
4. Allowing students proximity to the firing area.
5. Launching anything other than the commercially produced rocket engines of known size and predictable range.

9. Further rocket safety precautions can be found within the CA Science Safety Handbook, 2014, pages 169-170, 282-286.

## *Regulated Drones*

Projects involving unmanned aircraft systems (UAS)/drones must follow all state, Federal, and country laws. See the Federal Aviation Administration (FAA) for more details.

## *Hazardous Devices*

The documentation of risk assessment is required when a student researcher works with potentially hazardous/dangerous equipment and/or other devices, in or outside a laboratory setting that require a moderate to high level of expertise to ensure their safe usage. Some commonly used devices (Bunsen burners, hot plates, saws, drills, etc.) may not require a documented risk assessment, assuming that the student researcher has experience working with the device. Use of other potentially dangerous devices such as high vacuum equipment, heated oil baths, NMR equipment, and high temperature ovens must have documentation of a risk assessment. It is recommended that all student designed inventions also have documentation of a risk assessment.

## *Radiation*

A risk assessment must be conducted when a student's project involves radiation beyond that normally encountered in everyday life. Non-ionizing radiation includes the spectrum of ultraviolet (UV), visible light, infrared (IR), microwave (NW), radiofrequency (RF) and extremely low frequency (ELF)

## *Biofuels*

1. Research regarding biofuel/alcohol production must conform to the U.S. Department of Treasury, Alcohol and Tobacco Trade Bureau regulations.

2. Permits must be obtained prior to the production of any alcohol fuel. Application and Regulation information for permits visit: https://www.canr.msu.edu/uploads/files/Fuels/Small/Application.pdf

## *Potentially Hazardous Biological Agents (PHBA)*

1) Prior review and approval is required for the use of potentially hazardous microorganisms (including bacteria, viruses, viroid, prions, rickettsia, fungi, and parasites), recombinant DNA (rDNA) technologies or human or animal fresh/frozen tissues, blood, or body fluids:
2) An affiliated fair SRC, an IBC or an IACUC must approve all research before experimentation begins. The initial risk assessment determined by the student researcher and adults supervising the project must be confirmed by the SRC, IBC or IACUC.
3) Experimentation involving the culturing of potentially hazardous biological agents, even BSL-1 organisms, is prohibited in a home environment. However, specimens may be collected at home as long as they are immediately transported to a laboratory with the BSL containment determined by the affiliated fair SRC.
4) Research determined to be at Biosafety Level 1 (BSL-1) must be conducted in a BSL-1 or higher laboratory. The research must be supervised by a trained Designated Supervisor or a Qualified Scientist. The student must be properly trained in standard microbiological practices.

5) Research determined to be a Biosafety Level 2 (BSL-2) must be conducted in a laboratory rated BSL-2 or above (commonly limited to a Regulated Research Institution). The research must be reviewed and approved by the Institutional Biosafety Committee (IBC) if the Regulated Research Institution requires the review. The research must be supervised by a Qualified Scientist. For a high school BSL-2 laboratory, the SRC must review and approve. The research must be supervised by a Qualified Scientist.
6) Students are prohibited from designing or participating in BSL- 3 or BSL-4 Research.
7) Laboratory studies designed to culture known clinically significant multidrug resistant organisms (MDROs) are prohibited.
    a) Representative examples include, but are not limited to the following known agents: MRSA (Methicillin-Resistant Staphylococcus aureus), VISA/VRSA (Vancomycin Intermediate or Resistant Staphylococcus aureus), VRE (Vancomycin-Resistant Enterococci), CRE (Carbapenem Resistant Enterobacteriaceae), ESBLs (Extended Spectrum Beta-Lactamase producing gram negative organisms), and fungi (yeasts or molds) with known resistance to antifungal agents.
8) All potentially hazardous biological agents must be properly disposed at the end of experimentation in accordance with their biosafety level. For BSL 1 or BSL 2 organisms: Autoclave at 121 degrees Celsius for 20 minutes, use of a 10% bleach solution (1:10 dilution of domestic bleach), incineration, alkaline hydrolysis, biosafety pick-up and other manufacturer recommendations are acceptable.

## *Classification of Biological Agents - Risk Groups*

Biological agents, plant or animal, are classified according to biosafety level risk groups. These classifications presume ordinary circumstances in the research laboratory, or growth of agents in small volumes for diagnostic and experimental purposes.

**BSL-1** risk group contains biological agents that pose low risk to personnel and the environment. These agents are highly unlikely to cause disease in healthy laboratory workers, animals or plants. The agents require Biosafety Level 1 containment. Examples of BSL-1 organisms are: Agrobacterium tumefaciens, Micrococcus luteus, Neurospora crassa, Bacillus subtilis.

**BSL-2** risk group contains biological agents that pose moderate risk to personnel and the environment. If exposure occurs in a laboratory situation, the risk of spread is limited, and it rarely would cause infection that would lead to serious disease. Effective treatment and preventive measures are available in the event that an infection occurs. The agents require Biosafety Level 2 containment. Examples of BSL-2 organisms are: Mycobacterium, Streptococcus pneumonia, Salmonella choleraesuis.

**BSL-3** risk group contains biological agents that usually cause serious disease (human, animal or plant) or that can result in serious economic consequences. Projects in the BSL-3 group are prohibited.

**BSL-4** risk group contains biological agents that usually produce very serious disease (human, animal or plant) that is often untreatable. Projects in the BSL-4 group are prohibited.

### *Levels of Biological Containment*

There are four levels of biological containment (Biosafety Level 1–4). Each level has guidelines for laboratory facilities, safety equipment and laboratory practices and techniques.

**BSL-1** containment is normally found in water-testing laboratories, in high schools, and in colleges teaching introductory microbiology classes. Work is done on an open bench or in an appropriate biosafety hood. Standard microbiological practices are used when working in the laboratory. Decontamination can be achieved by treating with chemical disinfectants or by steam autoclaving. Lab coats and gloves are required. The laboratory work is supervised by an individual with general training in microbiology or a related science.

**BSL-2** containment is designed to maximize safety when working with agents of moderate risk to humans and the environment. Access to the laboratory is restricted. Biological safety cabinets (Class 2, type A, BSC) must be available. An autoclave should be readily available for decontaminating waste materials. Lab coats and gloves are required; eye protection and face shields must also be worn as needed. The laboratory work must be supervised by a scientist who understands the risk associated with working with the agents involved.

**BSL-3** containment is required for infectious agents that may cause serious or potentially lethal diseases as a result of exposure by inhalation. Projects in the BSL-3 group are prohibited.

**BSL-4** containment is required for dangerous/exotic agents that pose a high risk of life-threatening disease. Projects in the BSL-4 group are prohibited.

## *Resources: Potentially Hazardous Biological Agents*

1) American Biological Safety Association: ABSA Risk Group Classification – list of organisms www.absa.org

2) American Type Culture Collection (ATCC) www.atcc.org

3) Biosafety in Microbiological and Biomedical Laboratories (BMBL) - 4th Edition. Published by CDC-NIH

https://www.cdc.gov/labs/BMBL.html

4) Canada – Agency of Public Health – list of non-pathogenic organisms

https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment.html

5) American Society for Microbiology https://www.asm.org

6) Microbiology Society Charles Darwin House 12 Roger Street London WC1N 2JU UK education@microbiologysociety.org http://microbiologyonline.org

7) NIH Guidelines for Research Involving Recombinant DNA Molecules. Published by National Institutes of Health. https://osp.od.nih.gov/biotechnology/nih-guidelines/

8) OSHA – Occupational Health and Safety Administration www.osha.gov

# CVUSD Science and Engineering Fair
# Student Guidebook
# 2022-2023

## *All Students*

1. Need to receive the registration code link from the district science fair coordinators
2. Need to register/create a profile account onto the district zfairs site.
3. Need to access student tab and read all necessary information
4. Need to download all necessary forms
5. Elementary students should fill out only EZ form. Contact your teacher or site administrator if you have questions.
6. Junior and Senior division students should fill all necessary forms
7. All forms are due on simsef.zfairs.com on or before January 21, 2022

## *Student process*

1. Choose a Science Fair Project: Resources:
    a. **How to Do a Science Fair Project**

2. **District Project Display Information**:
    a. Download, fill out, then upload Forms to zfairs site
    b. Create your Video. Examples of Junior division videos (Broadcom MASTERS winners)
        i. Elementary - 5 minutes max
        ii. Junior Division - 8 Minutes max
        iii. Senior Division - 10 Minutes Max
    c. Include in video:
        i. Students Name(s), Title of the project, Abstract, Project information, Data, Conclusion, and References
    d. Upload Video to district zfairs site
        i. Student information - Video URL section
    e. Upload Project Presentation
        i. Outlined on pages 5 and 6
    f. Upload Quad Chart

# 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
    a. Scientific Method/Process:
        i. 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).
    b. Engineering Project Goals:
        i. 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.
    c. Mathematics and Computer Project Goals:
        i. The project has a clear objective, has been thoroughly tested and the process is well documented to both practical and workable outcome(s).
3) Thoroughness
    a) 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 citation is needed.
4) Skills
    a) Credit is given for special skills needed for the construction or use of equipment and for mathematical, computational, observational, and design skills.
5) Clarity
    a) 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

# Video Presentation with Judging Questions

Here is your chance to tell the judges about your project. Present your summary on the important points of your project. Be sure to present a clear and organized video.

**Video Presentation Time Limits:**

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

# 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 a journal to support that contains notes and data that support the intent of the project?

| | |
|---|---|
| 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?

| | |
|---|---|
| 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?

| | |
|---|---|
| 5 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'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.

## 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?

# 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.

# 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.

## 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

Reviewing and completing the Risk Assessment Form when needed

## *SRC Pre-Approval Questions*

| 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?<br><br>(Human Subjects) | Certification of Compliance of Research Involving Human Subjects Form<br><br>Participant Informed Consent Form |
| investigations using your pet(s)? Fish?<br>Any other animals that have bones?<br><br>(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<br><br>(Chemicals) | Risk Assessment |
| The use or construction of model rockets?<br>Lasers?<br>UV Light? Radiation?<br>Guns or gun powder?<br>Fire?<br><br>(Hazardous or Dangerous Equipment) | Risk Assessment |
| Research and Data from a project previously entered into a Science and Engineering Fair?<br><br>(Continuation Project) | Continuation of Research Form |
| 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?<br><br>(Pathogenic Agents, Human or Animal Tissue) | Risk Assessment Form<br><br>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 |

| 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, and 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). |

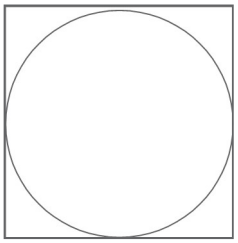
| **Category Number** | **Senior Division Project Categories** | |
|---|---|---|
| **S03** | **Applied Mechanics & Structures** | Studies concerning the design, manufacture and operation of mechanisms, including characteristics of materials, dynamic response and active/ passive control. Testing for strength 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). |

# Abstract 2022-2023

| | |
|---|---|
| **Project Title** | |
| **Student Name(s)** | |
| **Team Member Name(s) 1.** | |
| **2.** | |
| **3.** | |
| **District Name** | |
| **School Name** | |
| **Teacher Name** | |
| **Grade Level** | |
| **Abstract**<br>**Your abstract should be written after you finish the research and experimentation and should include:**<br>500 words or less (to fit on one page)<br><br>Purpose of the project<br><br>Hypothesis or evaluation criteria<br><br>Brief statement about procedures and equipment<br><br>Results (analysis of data)<br><br>Conclusions | |

| | Category Selection<br>Mark an "X" for your category selection. |
|---|---|
| | 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

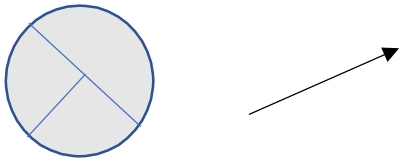
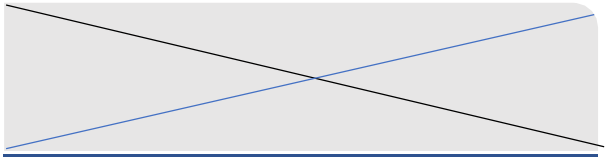
5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ YES ☐ NO

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.

7. You must use a page size no larger than either American standard 8½"X11" or European standard A4.
8. The page background color must be white.
9. Text color must be predominantly black, but limited color for emphasis is acceptable.
10. 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.
11. 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).
12. The Quad Chart should not include a bibliography, references, or acknowledgments.

| **Science Project Quad Chart** | |
|---|---|
| Q1: Research Question<br>• <br>• <br>• <br>• | Q3: Data Analysis & Results<br>  |
| Q2: Methodology<br>• <br>• <br>• <br>• <br>• <br>• | Q4: Interpretation & Conclusions<br>• <br>• <br>• <br>  |

| **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, country

### *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

## Science Backboard Sample


## Engineering Project Backboard Sample