CONCEPT
SCIENCE & ENGINEERING FAIR

Policy & Procedure Manual

Official Website

stemcon.net/consef

AIMS AND OBJECTIVES OF THE POLICY AND PROCEDURE MANUAL

The primary aim of this manual is to communicate the information needed by the student and mentor so that a safe and humane experimental project or paper is presented at the fair. Please read this book carefully and resolve any questions before you start your project.

Projects that are sent to the CONSEF that do not meet the rules, regulations, and guidelines of the manual will be disqualified.

Safety rules are not meant to be barriers to progress that have been arbitrarily imposed to make it difficult for students to present a project. The objective of the *Policy and Procedure Manual* is to provide policies and procedures that are designed for the safety of the experimenter, as well as the safety of those that will judge and/or view the project.

Join CONSEF!

CONSEF is open to Concept Schools students only.

www.consef.org

A copy of this manual should be given to all science project coordinators, mentors and student participants

This manual may be downloaded from the CONSEF website and duplicated as needed.

www.consef.org.

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MISSION STATEMENT

The mission of the Concept Science & Engineering Fair is to increase public awareness in science, math and engineering. We believe that every student has the potential to shine in science, math, and engineering, and therefore we encourage every student to share their experiences, talents, and abilities with other students through this unique platform.

WHY SHOULD YOU ATTEND?

There are numerous **reasons** why you want your students to be involved in the Concept Science & Engineering Fair. It

- builds students' self-confidence through independently-created projects
- allows for individualized attention and the expression of individual differences
- offers opportunities for struggling students to shine outside of the classroom
- naturally develops students' reading, writing and communication skills
- allows students to apply important math concepts to real-world situations using the following skills:
    - estimating
    - measuring
    - using algebraic and analytical methods
    - solving problems
    - predicting results
    - collecting, organizing, and analyzing data using statistical methods
- improves students' understanding of scientific inquiry and technological design through the following processes:
    - investigating questions
    - conducting experiments
    - solving problems
    - examining the interconnections between life sciences, physical sciences, and earth sciences
    - exploring the relationship between science, technology and society
- provides a great opportunity for parents' involvement in their student's work
- brings a large number of family and community members together
- shows the greater community tangible and real products created by students related to science, math, and technology
- supports the burgeoning charter school movement in the Midwest

CATEGORIES

Students must design an experiment to investigate a question or problem, or design or develop a new model, or computer program, or solve a mathematical proof, and so forth. **A project based solely on library research is NOT an acceptable project. Note that a model or demonstration is not an acceptable project.**

BEHAVIORAL SCIENCE (BEH)
Human and animal behavior, social and community relationships— psychology, sociology, anthropology, archaeology, ethology, ethnology, linguistics, learning, perception, urban problems, reading problems, public opinion surveys, educational testing, etc.

BIOCHEMISTRY (BIO)
Chemistry of life processes—molecular biology, molecular genetics, enzymes, photosynthesis, blood chemistry, protein chemistry, food chemistry, hormones, etc.

BOTANY (BOT)
Study of plant life—agriculture, agronomy, horticulture, forestry, plant taxonomy, plant physiology, plant pathology, plant genetics, hydroponics, algae, etc.

CHEMISTRY (CHEM)
Study of nature and composition of matter and laws governing it—physical chemistry, organic chemistry (other than biochemistry), inorganic chemistry, materials, plastics, fuels, pesticides, metallurgy, soil chemistry, etc.

COMPUTER SCIENCE (COMP)
Study and development of computer hardware, software engineering, internet networking and communications, graphics (including human interface), simulations / virtual reality or computational science (including data structures, encryption, coding and information theory).

EARTH & SPACE SCIENCE (EARTH)
Geology, mineralogy, physiography, oceanography, meteorology, climatology, astronomy, speleology, seismology, geography, etc.

ELECTRONICS/ENGINEERING(ENG)
Technology projects that directly apply scientific principles to manufacturing and practical uses—civil, mechanical, aeronautical, chemical, electrical, electronic, photographic, sound, automotive, marine, heating and refrigerating, transportation, environmental engineering, etc.

ENVIRONMENTAL SCIENCE (ENV)
Study of pollution (air, water, and land) sources, and ecology.

HEALTH SCIENCE (HEALTH)
Study of diseases and health of humans and animals—dentistry, pharmacology, pathology, ophthalmology, nutrition, sanitation, dermatology, allergies, speech and hearing, etc.

MATERIALS SCIENCE (MAT)
Study of materials and how they can be adapted and fabricated to meet the needs of modern technology.

MATHEMATICS (MATH)

Development of formal logical systems or various numerical and algebraic computations, and the application of these principles—calculus, geometry, abstract algebra, number theory, statistics, complex analysis, probability.

MICROBIOLOGY (MICRO)

Biology of microorganisms—bacteriology, virology, protozoology, fungi, bacterial genetics, yeast, etc.

PHYSICS (PHY)

Theories, principles, and laws governing energy and the effect of energy on matter—solid state, optics, acoustics, particle, nuclear, atomic, plasma, superconductivity, fluid and gas dynamics, thermodynamics, semiconductors, magnetism, quantum mechanics, biophysics, etc.

ZOOLOGY (ZOO)

Study of animals—animal genetics, ornithology, ichthyology, herpetology, entomology, animal ecology, paleontology, cellular physiology, circadian rhythms, animal husbandry, cytology, histology, animal physiology, invertebrate neurophysiology, studies of invertebrates, etc.

SCIENCE RESEARCH

Research is the process by which people create new knowledge about themselves or the world in which they live in order to answer a question or solve a problem. When choosing your topic, give careful thought to how your research might enhance the world and its inhabitants. Questioning is probably the most important part of scientific creativity and is often followed by an "if...then" statement. Questioning usually leads to experiments or observations. Good scientists, both young and old, use a process to study what they see in the world. The following six stages listed below will help you produce a good scientific experiment:

- ❖ Be curious, choose a limited subject, ask a question; identify or originate/define a problem.
- ❖ Review published materials related to your problem or question.
- ❖ Evaluate possible solutions and guess why you think it will happen (hypothesis).
- ❖ Challenge and test your hypothesis through experimentation (data collection) and analysis.
- ❖ Evaluate the results of your experiment and reach conclusions based on your data.
- ❖ Prepare your report and exhibit.

Students should learn to be skeptical of all research results, especially their own. A good experiment may or may not answer the questions asked, but usually leads to fresh questions requiring new experiments or observations. The experimental hypothesis is often developed after one has run a number of preliminary experiments, analyzed a body of results, and reached a tentative conclusion for your experiment.

Each participant needs to get approval from mentor teacher and/or science fair coordinator. Some participants may need SRC/IRB approval prior to experimentation. Please refer to the CONSEF Rules. The CONSEF Rules and regulations along with the needed forms are available at our website www.consef.org.

THE PROCESS OF A SCIENCE PROJECT

1- CHOOSE YOUR TOPIC

- Get an idea of what you want to study. Ideas might come from hobbies or problems you see that need solutions. Due to limited time and resources, you may want to study only one or two specific events.
- Be creative! Plan a project that is original in plan or execution. The project should express scientific ideas in new or better ways.
- Be scientific: investigate and explore an interest or fascination, something that gives you a question you would like to be able to answer. The library is an excellent place to start.
- The student should consider the research problem in relation to his or her scientific background, financial situation, desire to contribute to science, the time required for the study, and the availability of resources and materials.
- The experimentation behind a science project is what is significant. It is not the choice of the topic that is most important, but the way the project is handled. Sometimes the simplest topic offers the greatest challenge to the imaginative and intelligent student.

2- CHOOSE THE METHOD OF THE STUDY-*Experimental or Design Process*

Most projects will be experimental in nature using the scientific process and will fall into the experimental investigation classification. Experimental projects start with a question and a hypothesis, use the scientific method to complete the research, and end with a report detailing the results and conclusions and an abstract. However, if the objective of your project is to invent a new device, procedure, computer program, or algorithm, then your project may fall into the design investigation process.

Make the selection of the **Methods of the Study** on the online application form to make sure that the correct rubric will be assigned to your project.

3- A. EXPERIMENTAL PROJECTS

Define Your Problem

- Organize everything you have learned about your topic. At this point, you should narrow your thinking by focusing on a particular idea. Your background research should help you.
- You need to define and word your problem as a statement.

Perform Background Research

- Before you begin your project, you must become as knowledgeable as you can about your topic and about other research that has been done on that topic. You may use books, scientific literature, the Internet, or interviews with scientists or other knowledgeable people. Make sure that you document and cite all sources.

Formulate A Hypothesis

- Based on the background research and your defined problem, write a statement that predicts the outcome of the experiment.
- Many hypotheses are stated in an "if . . . then" statement where the "if" statement pertains to the independent variable, and the "then" statement pertains to the dependent variable. For example, if plants are grown with different types of fertilizers, then the plants grown with Fertilizer A will show the greatest increase in biomass.

Make a Timetable

- Choose a topic that not only interests you, but can also be done in the amount of time you have.
- Use a calendar to identify important dates.
- Leave time to fill out the forms and to review the Research Plan with your Mentor.
- Certain projects require more time because they need prior Scientific Review Committee (SRC) or Institutional Review Board (IRB) approval.
- Allow plenty of time to experiment and collect data - even simple experiments do not always go as you might expect the first time or even the second time.
- Also, leave time to write a paper and put together an exhibit.

Plan Your Experiment

- Give careful thought to experimental design. Once you have a feasible project idea, write a research plan. This plan should explain how you will do your experiments and exactly what it will involve.
- Decide what data you need to meet in your research objective and how you will collect it.
- Be sure to consider possible hazards in your experimental approach and decide how you can conduct your research safely.
- In order to obtain valid experimental results, consider the following items when designing the experiment:

    - Make sure the quantity and quality of data you collect provides a reasonable assurance that your research objectives will be met.
    - Identify all significant variables that could affect your results.
    - Include a control or comparison group in your experimental design.
    - Also, remember to use metric measurements whenever possible.

Consult Your Mentor and Get Approvals

- All students participating in the CONSEF are required to complete the Online Application that includes Abstract, Safety Form, and Endorsements (if applicable).
- You are required to discuss your research plan with your Mentor and obtain a his/her approval. In reviewing Abstract, your Mentor and you should determine if additional forms and/or IRB/SRC prior approvals are needed.

Conduct Your Experiments

- Follow your experimental design to collect data and make observations.
- Be sure to keep a log as you conduct the experiment to record your data, any problems you encounter, how you addressed them, and how these problems might have affected your data. Do not rely on your memory. This log will be used when you write your report.
- Remember to change only one variable at a time when experimenting, and make sure to include control experiments in which none of the variables is changed.
- Make sure you do sufficient trials in both control and experimental groups to be statistically valid.

Examine Your Results

- When you complete your experiments, examine and organize your findings.
    - Did your experiments give you the expected results? Why or why not?

- Was your experiment performed with the exact same steps each time?
- Are there other explanations that you had not considered or observed?
- Were there errors in your observations?

- If you get results that seem wrong or inconsistent, do not just throw them out. Try to figure out what happened. Maybe the data is correct and your hypothesis is flawed. Try to explain these "outliers" in your report.
- Don't get discouraged when you encounter problems. Scientists often have to repeat experiments to get good, reproducible results. Sometimes you can learn more from a failure than you can from a success.

Draw Conclusions

- Your conclusion should provide all the information necessary for someone who is unfamiliar with your project to understand what you were trying to accomplish, how you did it, and whether you succeeded.
- Which variables are important? Did you collect enough data? Do you need to conduct more experimentation? Keep an open mind - never alter results to fit a theory. If your results do not support your hypothesis, you still have accomplished successful scientific research.

3- B. DESIGN PROJECTS

Define a Need or a Real-World Problem

- Instead of stating a question, state a need. Can you describe in detail a problem that your design will solve? Does your research relate to a real-world need?

Perform Background Research

- For a design project, the background research may include:
  - A complete description of your target user(s)
  - Information about the science behind your design area
  - Answers to research questions about user needs
  - Information about products that meet similar needs
  - Research about design criteria
  - What existing solutions are out there already, and how well do they solve the problem?
- You may use books, scientific literature, the Internet, or interviews with scientists or other knowledgeable people

Establish Design Criteria

- Engineering Projects: Decide what features your design must have, for example: size, weight, cost, performance, power, and so forth. Include a table showing how each design criterion will be addressed by the features of the product being designed.
- Computer Science Projects: Create or write a new algorithm to solve a problem or to improve on an existing algorithm. Discuss the criteria of the algorithm.
    - Mathematics Projects: Develop proofs, develop a new model or explanation, concept formation, or mathematical model design.

Prepare a Preliminary Design

- Engineering projects should have a materials list, programming and mathematical projects do not need a materials list. Projects should include a block diagram, flowchart or sketch of the design that shows all of the parts or subsystems of the design. Describe how all of the parts of the design will work together.

Consult Your Mentor and Get Approvals

- All students participating in the CONSEF are required to complete the Online Application that includes Abstract, Safety Form, and Endorsements (if applicable).
- You are required to discuss your research plan with your Mentor and obtain a his/her approval. In reviewing Abstract, your Mentor and you should determine if additional forms and/or IRB/SRC prior approvals are needed.

Construct and Test a Prototype

- Programs, algorithms, and mathematical models may be considered prototypes
- When others are conducting their experiment, investigators doing an engineering project, computer programming, or mathematics project should be constructing and testing a prototype of their best design. For example, you may involve targeted users in your testing to get feedback on your design; or some projects may analyze data sets.

Test and Redesign as Necessary

- Evidence that changes in design were made to better meet the performance criteria established at the beginning of the project. Test results may be included in tables, if applicable. Data analysis/validation may also be a part of this step.

Analyze the Design and Draw Conclusion(s)

- Your report should provide all the information necessary for someone who is unfamiliar with your project to understand what you were trying to accomplish, how you did it, and whether you succeeded. The report should not only discuss your successful design attempts, but also the problems you encountered and how you solved them. Be sure to explain what new knowledge has been gained and how it leads to further questions.

4- WRITE A REPORT

- Your report should be detailed enough to allow someone else to duplicate your experiment exactly.
- Be sure to include charts and graphs to summarize your data.
- The report should not only talk about your successful experimental attempts, but also the problems you encountered and how you solved them.
- In preparing the paper, the author should be concerned with the following mechanics:
    - The paper must be typed, doubled spaced and have at least one-inch margins.
    - Use only one side of the page.
    - The font style and size (ex: 12 pt, Times New Roman) must be appropriate for a scientific paper.
    - The paper must be neat and legible.
    - There is no limit on the number of pages permitted in the project session portion of the exposition.
    - Type the last name of the student listed on the first line of the abstract at the top of each page.
    - Tabular information should be kept to a minimum. Each table, chart, or drawing should not be more than one page in length and tabular data should not be duplicated in the text. Headings for tables and columns should be brief.
    - Graphs should be suitably titled and have both axes correctly labeled. Do not forget to include the correct units of measurement for any numbers.
    - Photographs should be of good quality and contrast, and should have captions typed under them.
    - The use of the first person "I" or "We" should be avoided whenever possible. Terms such as "The research experiment" or "The exhibitor" are examples of third person usage.

- The following section establishes the basic written report requirements. The main point to keep in mind is to think before you write, then rethink, revise, rewrite, and reread again and again. Make it clear and concise.

The Physical Arrangement of the Written Report of the Experimental Project

- **Abstract** - is a concise summary of your work. It should be typed single-spaced with maximum 250 words.
- **Safety Form** – This form is required to be completed for all projects prior to experimentation.
- **Endorsements** - When human or non-human vertebrates or microorganisms are used, endorsement sheets are required. Forms are found at http://www.consef.org/?page_id=121
- **Title Page** - your title should be concise and clear.
- **Table of Contents** - include page numbers.
- **Acknowledgments -** should give credit to those who have helped you in your investigations for guidance, materials, and/or use of facilities.
- **Purpose and Hypothesis** - should state precisely the question you are attempting to investigate. Include your hypothesis or the expected outcome of your test.
- **Review of Literature** - is to report to the reader background information and/or work done in the past that pertains to your project. These references should be properly documented and listed in the section "Reference List".
- **Materials and Methods of Procedure -** should be a simple chronological account of what was done. The explanation of what was done must be clear and detailed enough so that the reader can duplicate the work. The apparatus and materials used should be listed - explain the workings of any apparatus you constructed or used. Drawings, diagrams that are clearly labeled, and photographs are appropriate if they enhance and clarify your explanation - do not use them as filler.
- **Results** - should be organized in tables and/or charts with graphic presentations, when applicable. Choosing the appropriate graph is important. The graphs should be presented so that they are easily read by someone not familiar with the work. If quantitative data are not involved, a day-by-day log may be used in place of the tables and charts. In either case, care should be taken to insure accuracy and clarity. A discussion section should follow the data section to include your evaluation and interpretation of the data and/or results of your investigation.
- **Conclusion** - should be a concise evaluation and interpretation of the data and/or results. The conclusion should be limited to the results of the investigation and should refer to the stated purpose and hypothesis. Experimental error should be estimated and considered when drawing the conclusion.

- **Reference List -** is a list of published articles, books, and other communications actually cited in the paper. Sources should be current.

The Physical Arrangement of the Written Report of the Design Project

- **Abstract** - is a concise summary of your work. It should be typed single-spaced with maximum 250 words.
- **Safety Form** – This form is required to be completed for all projects prior to experimentation.
- **Endorsements** - When human or non-human vertebrates or microorganisms are used, endorsement sheets are required. Forms are found at http://www.consef.org/?page_id=121
- **Title Page** - your title should be concise and clear.
- **Table of Contents** - include page numbers.
- **Acknowledgments -** should give credit to those who have helped you in your investigations for guidance, materials, and/or use of facilities.
- **Problem or Need** – Precisely state the question you are attempting to investigate. Include your hypothesis or the expected outcome of your testable question.
- **Background Research** – You should report to the reader background information and/or work done in the past that pertains to your investigation. These references should be properly documented and listed in the section "Reference List." Traditional footnotes are not to be used for citing references. The correct citation style to use is discussed in detail in the Publication Manual of the American Psychological Association.
- **Design Plan** – This should be a simple step-by-step account of what was done. The explanation of what was done must be clear and detailed enough so that the reader can duplicate the work. The apparatus and materials used should be listed. Explain the workings of any apparatus that was constructed or used. Drawings, diagrams that are clearly labeled, and photographs are appropriate if they enhance and clarify your explanation. Do not use them as filler.
- **Results and Discussion**
    - Constructing and Testing the Design Prototype – a description of the prototype/computer program/mathematical algorithm has been included. The prototype has been tested and the results have been discussed. . This may involve targeted users and/or analysis of data sets. (This may or may not include traditional data such as tables and graphs.

- Results of Testing and Redesign - Testing results have considered the parts and subsystems that required redesign in order to meet the performance criteria, and the redesign shows the changes in parts and subsystems.
- Redesign and Retest - Shows evidence that changes in design were made to better meet the performance criteria established at the beginning of the project. Test results may be included in tables, if applicable. Data analysis/validation may be present.

- **Conclusion** - should be a concise evaluation and interpretation of the data and/or results. The conclusion should be limited to the results of the investigation and should refer to the stated purpose and hypothesis. Experimental error should be estimated and considered when drawing the conclusion.

- **Reference List -** is a list of published articles, books, and other communications actually cited in the paper. Sources should be current.

PREPARE A DISPLAY BOARD

- For CONSEF judging, you must prepare a display board to accompany the written report.
- The title should be brief, captivating, and sufficiently descriptive to identify the project.
- Displays should be neat and presentable.
- Lettering should be neat, easily visible, and uncluttered. Check correctness of spelling.
- Do not display any previous awards on your project.
- Wall space for posters is not available. Construct displays so that wall space is not required.
- Exhibitors should bring their own tape, thumbtacks, and other supplies.
- Before judging, all of the displays will be carefully inspected by the safety committee.
    - A copy of the Abstract, Safety Sheet, and Endorsements (if applicable) must be displayed on the poster board.
    - Your display must not exceed the dimensions of 76 cm front to back, 122 cm from side to side, and 152 cm from table to top. This applies to ALL parts of your project. No apparatus may exceed this space. No apparatus may be under, behind, in front of, alongside, or hanging off of the display table. No apparatus that posses a safety risk to viewers may be displayed and may be removed at the discretion of the Safety Chair.
    - Your display must be designed to sit on a table and be self-supporting.
    - Spotlights, floodlights, or decorative lighting must not be used to illuminate your display.

- Any violation of these safety regulations will result in a letter to the mentor with the reason for disqualification or potential disqualification. No project will be disqualified if the safety violation can be corrected on the spot with a minimum of effort.
- The fair day is neither the time nor place to demonstrate your experiment. You should leave all lab equipment at home or at school. Pictures, drawings, and diagrams should replace equipment.

5- PREPARE AN ORAL REPORT

- For CONSEF judging, you must also prepare an oral report to accompany the written report.
- Introduce yourself. State your name, age, and school.
- Give credit to those whom you have contacted and to those who have helped you.
- Discuss any work done in the past pertaining to your project.
- State exactly what you were attempting to discover.
- Make a prediction about the outcome.
- How did you get interested in this project? Give the reason for choosing it.
- Background explanation for your project (to familiarize the judges), scope of your study, etc. This should include a summary of the Review of Literature.
- Proceed in a logical manner, telling what you did step-by-step.
- Be complete. Do not leave out necessary details.
- Use visual aids: charts, pictures, graphs. Point to your display, but stand aside when you do this.
- Explain how your apparatus was used. If you constructed it yourself, tell the judges you did it, if not, give credit to those who helped you. Judges are more interested in your results and conclusions than in the apparatus.
- Discuss ways you avoided experimental error such as use of appropriate instrumentation and measurements, large enough sample size, and/or having controls when possible.
- Discuss statistical aspects of experimental errors such as averages, ranges, and statistical analogies.
- Explain both your controls and your experimental variables.
- Remember to use proper units of measure with your data.
- Point to graphs, charts, etc., when you refer to them.
- State in a concise and logical order the conclusions you can validly draw from the experimentation you have done and the data and/or observation obtained.
- Discuss how you plan to continue your project, if applicable.
- When you have finished, ask the judges if there are any questions they would like to ask.
    - When they ask you questions, think before you answer them. Answer slowly! If you don't know the answer say, "I'm not sure but I think..."

- If they ask you a question that is not related to your project and you do not know the answer, then say, "I really haven't been concerned with this in my project, but it might be interesting to look into it."
- Thank the judges for any suggestions they may have for bettering your research.
- Speak slowly!
- Be forward but polite, dynamic, and above all interested in what you are doing.
- Remember that you are a salesperson and therefore your job is to sell your product to the judges. The judges are interested in your work - which is why they are judging you.
- Your presentation should not exceed 10 minutes.

RULES AND REGULATIONS

The student and the mentor have ultimate responsibility for the safety of the student and test subjects.

- Your school must currently be a member of the Concept Science & Engineering Fair.
- Grades 5-8 make up the Junior Division, while grades 9 - 12 are the Senior Division.
- No projects presented in previous years will be allowed at the fair unless they have been improved and expanded upon and are the result of further research and experimentation.
- A typed research paper must be displayed with your project. The Abstract is the first page of the research paper and serves as the cover sheet.
- A typed Safety Form should be displayed. If your project involves human or non-human vertebrates, vertebrate tissues, microorganisms, the appropriate Approval forms must follow the Safety Sheet in your research paper. Lack of this Endorsement may result in disqualification.
- A student may enter only one project.
- No team projects are allowed.
- Maximum amount of projects participating in CONSEF are restricted to 45 in each division form each school.
- Normal wear and tear on the exhibit is to be expected during the time that the exhibit is open to the public. If valuable equipment is on display, it is your responsibility for its supervision.
- Science Fairs are the times for communication. You are being judged on your ability to present your research to a scientist. This is neither the time nor place to demonstrate your experiment. You should leave all lab equipment at home or at school. Pictures, drawings, and diagrams should replace equipment.
- The participants only in Computer and Electronic/Engineering categories may bring their personal laptops to present their projects. **Outlets will not be provided.** Please arrange to have adequate back up power.
- CONSEF is open to any Concept Schools student from grades 5-12.
- All projects are subject to a pre-selection process based on the criteria listed on http://www.consef.org/?p=3319. The selected projects will be announced one month prior to the day of the event. See the important dates.
- For more information, reach us by e-mail at info@consef.org.
- Design Projects: Most projects will be experimental in nature using the scientific method and will fall into the experimental category. However, if the objective of the project is to invent a new device, procedure, computer program, or algorithm, then the project may fall into the Design category. Design Process Skills can be implemented in all categories and the Design Project rubric will be different than the Experimental one. Students will have opportunity to choose their rubric style on the online application form.

SAFETY GUIDELINES FOR EXPERIMENTS AND DESIGN PROJECTS

Use the following guidelines to ensure project safety compliance. Please review the Endorsement Flowchart before starting your project.

Why Are These Rules Necessary?

Many science and engineering projects involve chemicals, equipment, electricity, heat, or other potential hazards. Following safe laboratory practices helps protect students, sponsors, judges, families, and the environment. Professional scientists receive safety training before working in laboratories. These rules are designed to help students learn and follow the same safe laboratory practices expected in schools, universities, and research facilities.

Projects that do not follow the safety rules may be disqualified from Concept Science and Engineering Fair.

AI Usage During Research

All sponsors are responsible for discussing the proper use of AI in research with all of their students, both middle and high school. Generative AI may be used as a support tool in student research, but it may not replace the student's own thinking, analysis, interpretation, or writing. Students are responsible for verifying AI-generated information and citations, documenting AI use when required, and following all applicable ISEF rules regarding acceptable and unacceptable uses of generative AI.

See the full ISEF Generative AI Use Guidelines for details and examples.

- Any project involving non-human vertebrate animals, recombinant DNA, bacteria and fungi, human or non-human vertebrate animal tissue, laser (except the lowest class laser), UV light, X-ray, radioactive materials, or high-intensity radio waves requires prior SRC approval. All required forms must be submitted before the experimentation.
- If your project involves bacteria and fungi, recombinant DNA, human and non-human animal tissue, laser (except the lowest class laser), U-V light, X-ray, radioactive materials, or high-intensity radio waves, you are required to do your research/experiment under the constant supervision of a qualified scientist in a university, a medical or research facility, an industrial institution, or in a school laboratory.
- If your project involves non-human vertebrate animals, you are required to do your research/experiment under the constant supervision of a qualified scientist in a university, a medical or research facility, an industrial institution, in a school laboratory, field.

SRC APPROVALS

When planning to experiment with bacteria and fungi, recombinant DNA, human and non-human animal tissue, or non-human vertebrate animals, laser (except the lowest class laser), UV light, X-ray, radioactive materials, or high intensity radio waves, follow one of two pathways to get SRC approval. Please click to see the Endorsement Flowchart.

OPTION 1

Work with a qualified scientist in a university, a medical or research facility, or an industrial institution, and get approval from their Science Review Committee.

Submit:

- Research Institutional/Industrial Setting Form (1C)
- Qualified Scientist Form (2)
- Designated Supervisor Form (3)
- SRC/IRB Approval Form (7)

If your project involves:

- Non-human vertebrate animals; Submit Non-Human Vertebrate Animal Form (5) additionally
- Human and non-human vertebrate animal tissue; Human and Non-Human Vertebrate Animal Tissue Form (6) additionally

OPTION 2

Work with a qualified scientist in a school laboratory and apply to the CONSEF Science Review Committee. Fill out the student application form and the required endorsement forms, then submit them for our team to review. You should hear by phone or e-mail from CONSEF within one week of submitting your forms. If not, please contact us at info@consef.org.

Submit:

- Qualified Scientist Form (2)
- Designated Supervisor Form (3)

If your project involves:

- Non-human vertebrate animals; Submit Non-Human Vertebrate Animal Form (5) additionally (Experimenting with the Non-human vertebrate animals can also be handled at home under the same circumstances described above)
- Human and non-human vertebrate animal tissue; Human and Non-Human Vertebrate Animal Tissue Form (6) additionally

Submitting these forms does not guarantee the project's qualification.

Submitting these forms does not guarantee the project's qualification.

USE AND CARE OF NON-HUMAN VERTEBRATES

- Experiments using vertebrates must be conducted with respect for life and an appreciation of humane considerations.
- The student and the sponsor are responsible for ensuring that all animals receive proper care in well-ventilated, well-lit locations, with proper nutrition, appropriate temperature, adequate water, and sanitary surroundings. Care must be taken to see that the organisms are properly cared for during weekends and vacation periods.
- No changes may be made in an organism's environment that could result in undue stress, injury, or death to the animal without prior approval.
- No vertebrates can be used as the independent or dependent variables in an experiment that could result in undue stress, injury, or death to the animal.
- No intrusive or pain-producing techniques may be used. These prohibited techniques include, but are not limited to:
- Surgery
- Injections
- Taking blood
- Burning
- Electrical stimulation
- Giving of over-the-counter drugs, prescription drugs, illegal drugs, or alcohol to measure their effect
- For maze running and other learning or conditioning activities, food or water cannot be withheld for more than 24 hours. If the animal has a high metabolic rate, food or water cannot be withheld for a period that would cause undue stress.

USE AND CARE OF MICROORGANISMS

- Only known, non-pathogenic microorganisms may be used.
- All microorganism experimentation must be conducted in a laboratory setting, such as a science laboratory or professional research facility.
- Experiments with microorganisms, except for Saccharomyces cerevisiae (Baker's yeast), may not be done at home.
- Any projects involving mold growth or the rotting of organic material must be conducted in a science laboratory or a professional research facility.
- It is the sole responsibility of all teachers/sponsors to teach students proper safety methods and aseptic techniques.
- Students should wear safety goggles, gloves, and wash their hands after each experiment.

- Projects involving viruses and recombinant DNA should be conducted with the assistance of a professional and comply with the National Institutes of Health (NIH) Guidelines, unless the project is limited to a kit obtained from a legitimate supply house.
- All cultures must be destroyed by methods such as autoclaving or with a suitable NaOCl (bleach) solution before disposal.

USE AND CARE OF HUMANS AS TEST SUBJECTS

- Any project involving human subjects requires IRB (Institutional Review Board) approval before experimentation. The IRB consists of at least one medical professional, one science teacher, and one school administrator.
- The participants must fill out the Human Subject Form (4) for each human tested and submit it to the IRB chair for approval.
- The IRB Approval Form (7) must be submitted through the online application form – consef.org.

If using humans as test subjects, the following rules must be observed:

- Humans must not be subjected to treatments that are considered hazardous and/or that could result in undue stress, injury, or death to the subject.
- Quantities of food and non-alcoholic beverages are limited to normal serving amounts or less and must be consumed in a reasonable amount of time.
- Normal serving amounts must be substantiated with reliable documentation, such as a food label. This documentation must be attached to the Humans as Test Subjects Endorsement form.
- No project may use over-the-counter drugs, prescription drugs, illegal drugs, or alcohol in order to measure their effect on a person.

HAZARDOUS CHEMICALS, ACTIVITIES OR DEVICES

The following rules apply to projects using hazardous chemicals, devices and activities. These include substances and devices that are regulated by local, state, country, or international law. Hazardous activities are those that involve a level of risk above and beyond that encountered in the student's everyday life. The student researcher must minimize the impact of an experiment on the environment.

Students may not:

- use fire arms, explosive materials or explosive chemicals or intentionally create explosions;
- use known carcinogens, mutagens, teratogens, or chemicals used as illegal drug precursors.
- obtain, possess, manufacture, or use prescription medications, controlled substances, illegal drugs, or cannabis products (including THC, CBD, and CBG);

- conduct experiments where consumable ethyl alcohol is produced by distillation. Fermentation studies in which minute quantities of ethyl alcohol are produced are permitted.
- intentionally produce, distill, concentrate, or purify hazardous chemical products;
- use x-rays or radioactive materials;
- conduct experiments that create unnecessary chemical, fire, heat, or radiation hazards

Note: Projects involving fermentation with baker's yeast (Saccharomyces cerevisiae) are covered under the Use of Biological Materials section. Any alcohol produced during permitted fermentation studies must remain incidental to the investigation and may not be distilled, concentrated, purified, or consumed.

Chemical Safety

- **When working with chemicals students must:**
- use chemicals only for their intended purpose and according to instructions;
- clearly label all chemical containers;
- never mix chemicals unless the procedure specifically requires it and store incompatible chemicals separately;
- avoid inhaling vapors or allowing chemicals to contact skin or eyes;
- dispose of chemicals according to school, laboratory, or local regulations; and
- conduct experiments involving hazardous fumes or vapors in a laboratory fume hood or another appropriately ventilated area.

Fire Safety

- **When working with combustible materials or open flames, students must:**
- keep flammable materials away from ignition sources;
- conduct burning procedures in a laboratory fume hood or another well-ventilated area that safely exhaust smoke and combustion products;
- use open flames only when necessary and under appropriate adult supervision;
- never leave an open flame unattended;
- secure loose clothing and tie back long hair;
- know how to extinguish fires safely; and
- have appropriate fire safety equipment readily available before beginning the experiment.

Heat Safety

- **When working with hot equipment or heated materials, students must:**
- use heat-resistant gloves or appropriate tools when handling hot objects;
- assume heated equipment remains hot until it has cooled completely;
- place hot equipment on heat-resistant surfaces;
- avoid rapid temperature changes that could cause glassware to break; and
- allow equipment to cool before storing or cleaning it.

Radiation and Light Source Safety

Projects involving lasers, ultraviolet (UV) light, infrared radiation, microwaves, or other non-ionizing radiation sources must be conducted safely and under appropriate adult supervision.

Students must:

- Projects involving X-rays or radioactive materials are not permitted.
- Only commercially manufactured Class 1, Class 2, or Class 3R lasers may be used. High-powered Class 3B and Class 4 lasers are not permitted.
- Use radiation-producing equipment only when appropriate for the project and under qualified adult supervision;
- Follow all manufacturer instructions and institutional safety requirements;
- Use appropriate shielding, barriers, or enclosures when required;
- Never look directly into a laser beam or aim a laser at any person or reflective surface;
- Wear protective eyewear appropriate for the wavelength of the laser or UV source whenever there is a risk of eye exposure;
- Wear clothing that protects exposed skin when working with ultraviolet (UV) light; and
- Never intentionally expose themselves or others to lasers, ultraviolet (UV) light, infrared radiation, or other radiation sources.

Storage and Disposal

- Students must safely store and dispose of all chemicals and hazardous materials.
- Store chemicals according to the manufacturer's instructions or the Safety Data Sheet (SDS).
- Keep incompatible chemicals separated.
- Clearly label all containers.

- Dispose of chemicals according to school procedures and all applicable local, state, and federal regulations.
- Never pour hazardous chemicals down a sink or place them in regular trash unless specifically permitted by the school or laboratory.

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 (https://faa.gov/uas/).

The Qualified Scientist

A Qualified Scientist should have a doctoral/professional degree (PhD, MD, or Master degree with additional experience and/or expertise) in a scientific discipline that relates to the student's area of research. The Qualified Scientist must be thoroughly familiar with the local, state, and federal regulations that govern the student's area of research. The Qualified Scientist and the Adult Sponsor/Mentor may be the same person, if that person is qualified as described above.

The Designated Supervisor

The Designated Supervisor is an adult who is directly responsible for overseeing student experimentation. The Designated Supervisor need not have an advanced degree but must be thoroughly familiar with the student's project and must be trained in the student's area of research. The Adult Sponsor/Mentor may act as the Designated Supervisor.
If a student is experimenting with live vertebrates and the animals are in a situation where their behavior or habitat is influenced by humans, the Designated Supervisor must be knowledgeable about the humane care and handling of the animals.

REGISTRATION

Please use the following steps to apply CONSEF project session.

STEP 1

- Create a school account. *Science Fair Coordinators Only*

    1. Start the registration process by creating a coordinator account for your school. http://reg.consef.org/Registration
    2. Activate your account through email you provided.
    3. Wait the CONSEF Organizing Committee approval for your school account.

- Fill out the School Registration Form. This will allow you to unlock the submission buttons.

    1. Pay the CONSEF school registration fee by PayPal, credit cards, or checks.
    2. The school registration fee covers 1-25 projects per school per division.
    3. Please the make the check or money order payable to Concept Schools.

- Use the account information to access the school and student information for the submission processes.

STEP 2

Create Teacher/Mentor Accounts-*Science Fair Coordinators Only*

- Create teacher/mentor accounts.

    1. Science fair coordinators can create teacher/mentor accounts if they want to share responsibilities in order to coach the students.

STEP 3

Create Student Accounts: *Science Fair Coordinators and/or Teachers/Mentors*

- Create student accounts and share the account information with your students.

    1. Science Fair coordinators, and teacher/mentors can add students directly into the system by simply creating their usernames and passwords.
    2. Science Fair coordinators and teachers/mentors have privilege to add/delete students.

STEP 4

Fill out the Student Application- *Student Only* http://reg.consef.org/Login

- Students can start filling out their applications upon receiving their usernames and passwords from their teachers/mentors or science fair coordinators.

    1. Students can only save and continue their applications. Students can submit their project only for seeking an approval from their mentors/science fair coordinators.

    2. Science Fair coordinators and teachers/mentors have privilege to edit the applications.

- All Endorsement Forms, if applicable, must be filled out, signed, and attached to the same online application form.

STEP 5

Approve/Disapprove- *Science Fair Coordinators and/or Teachers/Mentors*

- Teachers/Mentors need to review the students' applications and approve them for the further steps

- Teachers/mentors need to attach the students' Consent and Release form to the same online student application form signed by the parents/guardians.

- Science Fair coordinators are the only people who can submit the student applications to CONSEF for the preselection process.

STEP 6

Submit the applications to CONSEF- *Science Fair Coordinators Only*

- Upon teachers' approval, the science fair coordinator must submit the student applications to CONSEF.

STEP 7

Pre-selection- CONSEF Organizing Committee Only

- All projects are subject to a pre-selection process based on the criteria listed on http://www.consef.org/?p=3319. The selected projects will be announced one month prior to the day of the event.

- For more information, please call (847) 824 3380 Ext: 213 or reach us by e-mail at info@consef.org.

STEMCON DESIGN CONTEST

RULES OF PROCEDURE

- Any student in grades 4 through 12 whose school is a member of CONSEF is eligible to take part in the cover design contest.
- Use an 8.5"x11" sheet of white paper for each entry. The design MUST be oriented PORTRAIT, NOT LANDSCAPE.
- Include the motto of the year in your design. This should be large enough to be seen on your original design.
- The design must be original and may be computerized.
- The design must be in black and white.
- Only one entry is permitted per person during the Contest Period.
- Please include the following on the **back of student's entry**:
  Student's Information
  Student's Name
  Home mailing address
  Home telephone number
  E- mail

  Mentor's Information
  School name
  Name
  E-mail
  Phone number
- The design committee will judge all entries. The entries of the top ten finalists will be displayed at the Fair. The winning design will be printed on the program booklets.

- Awards:

  - First Place - Junior Division: $250
  - First Place- Senior Division: $250
  - Finalist: $25
  - Winning Mentoring teacher : $100

  Participate Online or Mail your application to:

  Concept Schools
  1336 Basswood Rd
  Schaumburg, IL 60172

JUDGING CRITERIA – SCORING RUBRICS

EXPERIMENTAL PROJECTS

OVERALL IMPRESSION OF THE PROJECT

Scientific Approach : (max-8 pts) – Well defined problem was solved using scientific principles.

Knowledge Gained : (max-10 pts)- Student has understood the topic, mastered the scientific skills, and answered all questions correctly.

Experimental Approach: (max-10 pts)- Dependent and independent variables were defined and control group was in evidence.

Reliability of Data : (max-8 pts) – Data is numerical and metric. Data is reliable with repeated trials.

Validity of Conclusion : (max-5 pts) – Conclusion is consistent with the data provided.

Originality : (max-10 pts) – Topic is original and method is highly creative.

DISPLAY

Information : (max-7 pts) – Display gives complete explanation with graphs, charts and pictures.

Technical Requirements : (max-4 pts) -Safety and endorsement sheets are displayed.

Artistic Qualities : (max-5 pts) - Backboard is neat, organized, and appealing. No spelling errors.

ORAL PRESENTATION

Presentation Quality : (max-10 pts) – Clear presentation which is easy to follow. Information is relevant.

Dynamics : (max-10 pts) – Speaks fluently with good eye contact, polite, dynamic, and interested in his/her subject. Not relied heavily on note cards or the board.

WRITTEN REPORT

Order : (max-5 pts) -Report is neat and in logical order (Title, content, acknowledgements, problem, hypothesis, review of literature, materials, procedure, results, conclusion, reference list).

Spelling/Grammar : (max-3 pts) -No spelling or grammatical error is present.

Review of Literature/Reference List : (max-5 pts) -Quality, quantity, and variety of sources is adequate for topic.

DESIGN PROJECTS

OVERALL IMPRESSION OF THE DESIGN PROCESS

Design Approach Overall: (max-8 pts) – Has identified a need or real world problem.

Knowledge Gained : (max-10 pts) -Exhibits a thorough understanding and the application of the design Student has acquired design skills.

Design Approach-Performance Criteria: (max-10 pts) -Clear performance criteria have been developed to address the features of the product, algorithm, proof, model, etc.

Constructing and Testing the Prototype: (max-8 pts) -Has constructed and tested a prototype. Data analysis/validation is evident.

Validity of Evaluation/Conclusion : (max-5 pts) -Conclusion accurately reports with the success/failure of the design.

Originality : (max-10 pts) – Topic is original and method is highly creative.

DISPLAY

Information : (max-7 pts) – Display gives complete explanation with graphs, charts and pictures.

Technical Requirements : (max-4 pts) -Safety and endorsement sheets are displayed.

Artistic Qualities : (max-5 pts) -Backboard is neat, organized, and appealing. No spelling errors.

ORAL PRESENTATION

Presentation Quality : (max-10 pts) – Clear presentation which is easy to follow. Information is relevant.

Dynamics : (max-10 pts) – Speaks fluently with good eye contact, polite, dynamic, and interested in his/her subject. Not relied heavily on note cards or the board.

WRITTEN REPORT

Order : (max-5 pts) -Report is neat and in logical order (Title, content, acknowledgements, problem, hypothesis, review of literature, materials, procedure, results, conclusion, reference list).

Spelling/Grammar : (max-3 pts) -No spelling or grammatical error is present.

Review of Literature/Reference List : (max-5 pts) -Quality, quantity, and variety of sources is adequate for topic

PRE-SELECTION CRITERIA – EXPERIMENTAL PROJECTS

- Scientific Approach: (max-8 pts): Well defined problem was solved using scientific principles.
- Experimental Approach: (max-10 pts) : Dependent and independent variables were defined and control group was in evidence.
- Validity of Conclusion: (max-5 pts): Conclusion is consistent.
- Originality : (max-10 pts)
- Topic is original and method is highly creative.

PRE-SELECTION CRITERIA – DESIGN PROJECTS

- Design Approach Overall: (max-8 pts): Has identified a need or real world problem.
- Design Approach-Performance Criteria: (max-10 pts): Clear performance criteria have been developed to address the features of the product, algorithm, proof, model, etc.
- Validity of Evaluation/Conclusion : (max-5 pts): Conclusion accurately reports with the success/failure of the design
- Originality :(max-10 pts): Topic is original and method is highly creative.

AWARDS

Fair Awards will be given according to the participants' scores:

Student Awards

Grand Awards: The top project (One student from each division).

- a certificate
- trophy
- $200 of monetary award

Gold : 91-100

- a certificate
- a medal
- $50 of monetary award

Silver : 81-90 points

- a certificate
- a medal
- $40 of monetary award

Bronze : 71-80 points

- a certificate
- a medal
- $30 of monetary award

Honorable Mention: 70-60

- a certificate
- a medal

Best of the Categories

- Best of the Category Award will be given to one participant in each category in both divisions. The top gold medal participant in each category will get this award. If two or more participants get a same score, then the score given by the third judge will be used as a tiebreaker. A 4th judge will be used if the tie still continues.
- a certificate
- a trophy
- $100 monetary award

School awards:

- In each division, the school receiving the highest average from their top 5 projects will win the "Best School Award".
- Schools participating in CONSEF with less than 5 projects will not be considered in this category.

INFORMATION FOR THE JUDGES

Judging is, without a doubt, one of the most important phases of any science fair. Because of its extreme importance, all judges should carefully review the following:

- Each student is to be judged based on the rating criteria and not in comparison to another student.
- Be aware that most students have spent many months preparing for a judging period, which normally lasts fifteen minutes. The opportunity to discuss their project with the judges is important. Students deeply appreciate all questions and comments.
- Allow yourself enough time to park your car and to allow for traffic interference so that you will report on time. Please report to the judging control room as soon as possible.
- At the judges meeting, you will be informed of any last minute changes and/or special requests concerning judging assignments.
- Each judge is to be assigned about six projects or more. Each student will be judged by three individuals.
- You may be asked to judge projects in both divisions, Junior - grades 5-8, and Senior - grades 9-12. If so, please keep the maturity of the participant in mind.
- It is essential that each judge finishes his/her judging responsibilities and have judging results turned into the Judging control room on time. There will be some staff members who will be assigned to collect the scoring sheets.
- Students must be with their project at the time of judging. If the student cannot be located within a reasonable period of time, then the project is considered a No Show, and no rating is to be given.
- Be pleasant and interested.
- Please remember that you are working with tomorrow's scientists; their "decision for science" may rest on the impression you leave on them.
- Each project judged must have a final score so that the certificate of award can be made. Do not show the student the score.
- Be sure every project for which you are responsible has been judged. Return the scoring rubric immediately following the judging of each project. DO NOT hold all scoring devices until you are finished judging all projects.

INFORMATION FOR PARENTS, MENTORS AND TEACHERS

PARENTS

We know that you are proud of the accomplishments of your son or daughter and that you are anxious to see them succeed in this introductory phase of a possible career or a lifelong interest in science. The parent's role is to support their son or daughter's independent efforts, not to take over the project. Your challenge is to provide just enough assistance to allow your son or daughter's own efforts to take center stage, while offering ideas and resources that might help your child raise their efforts to a higher level.

Keep in mind the following suggestions:

- Review the *Policy and Procedure Manual* and any other materials your son or daughter's science teacher (mentor) sends home about the requirements of the project.
- Encourage your child as he or she brainstorms ideas for the project. Make sure you understand what is required before approving a science project topic.
- Support your child in researching their topic and conducting the experiment.
- Make sure you are familiar with the safety guidelines and see that they are followed.
- Assist your child in getting needed experimental materials.
- Your child might need assistance in preparing their display board and presentation.
- Celebrate the successes and spend a moment looking at what went wrong.
- Special award judges may use other criteria for selecting their special awards.
- If in doubt, contact your son or daughter's science teacher or mentor for assistance or encourage your child to do so.
- **In all stages of competition, the judge's decision is final.**

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