Lakota SCIENCE AND ENGINEERING FAIR

Student Information Packet

2022-23

LAKOTA SCIENCE & ENGINEERING FAIR

Lakota's 4th Annual Science & Engineering Fair (LSEF) will take place the evening of **Friday, January 27, 2023,** at Lakota Ridge Junior School.

Projects can be **science-based** or **engineering-based**. A student may enter only one project per year. Student participants present their project with a poster display, a project abstract (full reports are now optional), and a short oral presentation.

We recommend all projects receiving a "Superior" rating at the Lakota Science & Engineering Fair to participate in the Southwest Science & Engineering Expo at the University of Cincinnati in the spring. Projects that receive a "Superior" rating at the UC event can move on to compete at the State Science Day.

Questions? Reach out to LakotaScienceFair@gmail.com

WHO CAN PARTICIPATE

Any Lakota student in grades 5 – 12 can participate. You can enter the Lakota Science & Engineering Fair as an INDIVIDUAL or TEAM. A Team includes 2-3 students in the same grade bracket (grades 5-6, grades 7-8, grades 9-12).

REGISTRATION

Registration for the Lakota Science & Engineering Fair costs $5 for an individual project or $8 for a team project, to be paid by check or electronic payment via the registration site.

Registration for the 2023 LSEF **CLOSES NOVEMBER 30, 2022.** You can register from our website at LakotaLEADS.org → Events → Science Fair. You can also find helpful materials there to guide you through the process of creating a project and preparing for the fair.

Questions? Contact LakotaScienceFair@gmail.com.

STAY CONNECTED

Sign up to receive our e-mail newsletter by emailing us at LakotaScienceFair@gmail.com.

Follow our Facebook page "Lakota Science & Engineering Fair" and our Twitter @LakotaScienceEngineeringFair to stay informed.

Visit our website at LakotaLEADS.org → Events → Science Fair for more helpful information.

PROJECT STEPS

1. **Choose a topic**:
   SCIENCE – A Science Project asks a question then uses the scientific method to propose and test a hypothesis. Pick something that interests you. Talk it over with your parents/teacher/coach. Your finished project can either prove or disprove your hypothesis – either way is equally good!
   ENGINEERING – An Engineering Project solves a problem or need. Pick something that interests you. Talk it over with your parents/teacher/coach. Your finished project should solve the problem you identified.
2. **Select a Coach (Optional)** – It can be helpful to have a teacher or other adult with expertise in science or engineering serve as a project Coach. A Coach is a resource who can provide insight and expertise to guide you. It is not their responsibility to direct you through the steps of the project.
3. **Register** online by November 30, 2022 (see Registration section above).
4. **Plan** on your project:
   a. Gather Background Information - What is it that you want to find out by doing this project? Look at any books/websites that might help you, make observations by simply looking at things, talk to people, and find out as much as possible about your topic. Write down any ideas you have and where you got them. Keep notes of all information and resources in your project notebook.
   b. SCIENCE - Hypothesis - What do you think is going to happen? Based on what you know or found out, what do you think the results of your experiments will be? Record your hypothesis in your project notebook. After doing the experiments, it may turn out that your guess was wrong. It is okay if this happens.
      ENGINEERING - Establish Design Statement or Criteria - Make your design criteria short but as specific as possible. Avoid vague language. List your primary criteria first; then list the secondary criteria. Often design criteria are best displayed in bulleted lists, with short titles preceding the explanation.
   c. Plan – Make a project timeline and follow it. Don't leave everything until the last minute. If you need help, tell your parents or coach, the earlier the better.
      SCIENCE - How will you test your hypothesis? What experiments will you do? How will you measure the results? Collect all your materials. Find a place to keep things safely. Let other family members know what you are doing, so they do not throw your materials away by mistake.
      ENGINEERING – Prepare preliminary designs. These are high-level designs that illustrate your ideas for how to fulfill your design criteria. Determine the approximate dimensions, weight, force, load limits, and other physical characteristics that will be required.
5. **SCIENCE - Begin Experimentation**:
   a. Experiment - Conduct your experiments. Remember, the more times you do an experiment, the more reliable and accurate the results will be. Do each

experiment at least three times and get an average of the results for your graph. Use something to measure your experiments: a ruler or yardstick, a clock, etc.

b. Record your data - As you do your experiments, you will want to write down what you saw or found out. Organize this information in an orderly manner. Put the date, time, and any other useful information. Write your measurements clearly.
c. Draw Conclusions - What did you learn from your experiments? Have you proved or disproved your hypothesis? You don't lose points if your guess turned out to be wrong.

ENGINEERING - Build a Prototype:

a. Build & Test – Gather the materials you need and build your design. If you need help, ask your parents or coach for advice or direction.
b. Test & Redesign – Test your prototype design. How well does it meet your design criteria? You will likely need to make adjustments to your design. Continue to test until your model meets your design criteria and you think you have achieved the best design possible.
c. Record your data - As you do your testing, you will want to write down your results. Record failed tests and adjustments made. Organize this information in an orderly manner. Put the date, time, and any other useful information. Write your measurements clearly.

6. **Project Notebook** - All roughwork and calculation should to be clearly written or typed in your project notebook as a record of your work. Research projects should have written documentation from the very beginning of the project starting with gathering ideas for the project. The information the student records in the notebook can be used to write the Project Report (now optional) for the project. Each time you add notes, record the date on each page you use. Detailed notes are essential during the process of setting up the experiment, the conditions, variables, observations, measurements, calculations, graphing results, discussion of the conclusions and implications. Include any other records such as photographs and discussion notes from your meetings with your teacher or coach (if you have one).
7. **Project Report** (now optional) – The rough notes from your Project Notebook can be neatly summarized in a typewritten Project Report (see below for details). Although this is optional for our LSEF event, it is required for projects that move on to represent Lakota at the district and state events.
8. **Project Abstract** (required) – An abstract is intended to provide a brief summary of all the information that would be in a full written report, but in no more than 250 words. It should include all the important points, so that someone reading it can understand the project quickly.
9. **Poster Display** – Foam trifolds are generally used (because they stand up by themselves), but poster board is also acceptable. Display the key elements of your project using charts, graphs, drawings, pictures, and diagrams. Make them large, neat, and colorful. Be sure all displayed information is clearly labeled. Projects that move on to the fairs at UC/State will need to upload their display information electronically (a photo of the trifold display is not acceptable,) so the more information you can create

electronically, the easier it will be to cut and paste it into an electronic "Quad Board" to upload.

10. **Oral Presentation** – The judges will come to each project during the Science & Engineering Fair to view your project and listen to your oral presentation. Be able to talk about what you did in your experiments and what you found out. For teams, each member of the team should take part in the presentation. Oral presentation time limit is 5 minutes (total, not for each team member). Prepare and practice your presentation with your friends, parents, coach, teacher. Have them time you, so you don't go over 5 minutes. After your presentation, the judges will ask a few questions. See below for some tips.
11. **Relax and enjoy yourself. You will do a GREAT job**!

PROJECT REPORT

In order to make the LSEF accessible for students who love the science or engineering projects but don't enjoy writing reports, we have now made the Project Report optional for our event. An Abstract is still required, but students who do not submit full reports will not be penalized. However, projects that move on to the UC/State fairs still require a full written report.

The Project Report is a summary of everything that you did to investigate your topic. Below you will find 2 project report formats - one for science projects and the other for engineering projects. Please pick the one that works for your project.

Submission Guidelines for All Reports:

- Reports should be typewritten and organized in a binder or folder
- Recommended format is typed, doubled spaced, one-inch margins, and 12 pt. Times New Roman Font
- Put headings/titles on all graphs/charts/tables
- Insert clear pictures
- Before you finalize your report, make sure to reread, revise, and rewrite
- Recheck your calculations, spelling, and grammar

Science Project Format:

Title: The first page in the report should include the title of the project as well as the name and grade of the student.

Acknowledgment: Here is where you thank everyone who helped to make your project successful (including parent, neighbor, coach, teacher etc.) Everyone that you interviewed, including teachers and other experts in the field should be mentioned here.

Statement of Purpose: State the purpose of the project **in the form of a question.**

Hypothesis: You must have a hypothesis before you complete the project. A hypothesis is a proposed explanation for the scientific phenomenon that you can test. While stating your hypothesis you focus on what you "predict" will occur as a result from completing your experiment.

Research: This is the part of the report that contains all the background information that you collected about your topic. Any books or articles read from the internet/journal, authorities on the topic that you talked to, or outside materials collected should be summarized in this section. **This section should be written in your own words and NOT copied from your resources.**

Materials: This is a list of all the materials and supplies used in the project. Quantities and amounts of each should also be indicated.

Procedure: You will list and describe the steps you took to complete the project. Usually this is listed in a numbered sequence. This part shows the stages of the project so that another person can carry out the experiment.

Observations and Results: In this section, you will tell what you learned from the project. It is also IMPORTANT to include all graphs, charts, or other visual data (pictures) that helps to show your results.

Conclusion: This is a brief statement explaining why your project turned out the way it did. You should explain why the events you observed occurred. Using the word "because" is a good way to turn an observation into a conclusion. The conclusion should tell whether the hypothesis was proven or not proven. Also give the reason(s) why you chose to learn more about the subject. You could also add what you know now that you didn't know before you completed your project.

Reference Page: The bibliography should list all the printed materials the student used to carry out the project. Items should be listed in alphabetical order in a standard format. These websites are a great place to go to find the proper way of writing a bibliography. http://www.bibme.org/, http://www.easybib.com or http://www.knightcite.com. Also http://www.lcyte.com lets you "tag" information from Internet sources as you research.

Engineering Project Report Format:

Title: The first page in the report should include the title of the project as well as the name and grade of the student.

Acknowledgment: Here is where you thank everyone who helped to make your project successful (including parent, neighbor, coach, teacher etc.) Everyone that you interviewed, including teachers and other experts in the field should be mentioned here.

Statement of Problem: Discuss the problem that motivated the need for your engineering design. Outline the design constraints and cost implications.

Research/Background of the Problem: This is the part of the report that contains all the background information that you collected about your topic. Any books or articles read from the internet/journal, authorities on the topic that you talked to, or outside materials collected should be summarized in this section. **This section should be written in your own words and NOT copied from your resources.**

Proposed Solution: This is the section where you present all possible solutions you came up with and explain how you made the decision about the final design. Make sure to explain how you considered needs and constraints to make this decision.

Procedure: You will list and describe the steps you took to complete the project. Usually this is listed in a numbered sequence. Below are the suggested sub-titles for this section:

- **Building a Prototype:** Provide a visual image (e.g., pictures or drawings) of your prototype. You may consider including visual image from different perspectives.
- **Materials:** This is a list of all the materials and supplies used in the project. Quantities and amounts of each should also be indicated.
- **Cost Effectiveness:** Explain how much the design cost and whether it is a reasonable expense for a design to address the problem.
- **Testing and Evaluating the Prototype:** In this section, you will explain how you tested and evaluated the effectiveness of your prototype. It is also IMPORTANT to include your evaluation criteria as well as all graphs, charts, or other visual data (pictures) that helps to show your results.

Conclusion: This is where you explain why your project turned out the way it did. You can start with the reasons why you chose to address this particular problem. Next, you must discuss how effective or successful your design was in addressing the problem you had identified. Then, you should discuss what you would do to improve your design in detail and reason for these revisions. Since engineers work to improve quality of life by addressing the problems identified in communities, it is important that you discuss how your project improves your target population's lives. In other words, explain the implications of your design.

Reference Page: The bibliography should list all the printed materials the student used to carry out the project. Items should be listed in alphabetical order in a standard format. These websites are a great place to go to find the proper way of writing a bibliography. http://www.bibme.org/, http://www.easybib.com or http://www.knightcite.com. Also http://www.Icyte.com lets you "tag" information from Internet sources as you research.

ORAL PRESENTATION

You are the expert, and you had fun doing the project. But if you are a little nervous, here are some tips that may help:

- Dress nicely, be polite, and speak clearly. Don't forget to look at your audience.
- Introduce yourself. Point to the title of your display. Tell your audience why you chose to study this.
- State the topic that you studied. Tell them about your hypothesis.
- Talk about what you learned while researching your topic.
- Talk about the sources (books, websites, and interviews) that helped you understand.
- Tell about your project and explain the steps you took to conduct your experiment.
- If it applies, be sure to show them that you tested your experiment at least 3 times.
- Show them all the graphic organizers that you made, like your tables and charts. Remember to point out the labeled parts of your graph or table.
- Make sure you can read your graphs and tables. Let them know if you were surprised by the results, or if you knew what would happen because you studied about it.
- Make sure you sound like an expert on your topic. Always use the appropriate vocabulary.
- Be sure your presentation only lasts 4-5 minutes. It's easy to get long-winded when you are nervous! Additional time is allocated for judges' questions.

SCORING:

Each project will be scored by a team of 2 judges, and the final score will be an average of the two judges' scores. The final score will determine if the project is rated Superior, Excellent, Good, or Satisfactory. Scores that average with a ".5" or higher will be rounded up, and anything lower than a ".5" will be rounded down. A third judge will rejudge a project if the two original judges' total scores are more than 5 points apart AND land the project in two different rating categories AND the average of the scores puts the project in the lower of the two categories.

The scoring rubrics the judges use are available on our website at LakotaLEADS.org → Events → Science Fair for your reference. Scores are given in these categories:

- Oral, Written, and Visual Communication
- Originality
- Experimental Design or Engineering Design
- Depth of Understanding
- Teamwork (for team projects)

AWARDS:

Projects with ratings of Good or better will receive a ribbon. The highest-scoring project in each category will receive a trophy. The top-scoring project must have a Superior rating to receive a trophy. If no project in a category receives a Superior rating, no trophy will be given in that category. Multiple projects in the same category can receive a Superior rating, but only one trophy will be given. Here are the project categories:

- Grade 5-6 Individual Science Project
- Grade 5-6 Team Science Project
- Grade 5-6 Individual Engineering Project
- Grade 5-6 Team Engineering Project
- Grade 7-8 Individual Science Project
- Grade 7-8 Team Science Project
- Grade 7-8 Individual Engineering Project
- Grade 7-8 Team Engineering Project
- Grade 9-12 Individual Science Project
- Grade 9-12 Team Science Project
- Grade 9-12 Individual Engineering Project
- Grade 9-12 Team Engineering Project

SAFETY REQUIREMENTS:

1. Safety is always first. Use all necessary precautions.
2. Never eat or drink during an experiment, and always keep your work area clean.
3. Wear protective goggles when doing any experiment that could lead to eye injury.
4. Do not touch, taste, or inhale chemicals or chemical solutions.
5. All experiments should be supervised by an adult.
6. Always wear gloves if you have been handling chemicals.
7. Dispose of waste properly.
8. Any experiments that involves animals, drugs, firearms, or explosives are NOT permitted.
9. Any project that breaks district policy, local, state, and/or federal laws are NOT permitted.
10. Be sure to let an adult know about what websites you will be visiting or have them help you search.
11. If there are dangerous aspects of your experiment, like using a sharp tool or experimenting with electricity, please have an adult help you or have them do the dangerous parts.
12. If you are working in a registered laboratory, research center or school laboratory, you

must follow the lab's safety guidelines. Please provide contact/location details of the lab and the manager of the lab.
13. If you think your project might involve the use of hazardous chemicals, you should not handle them yourself; your parent, teacher or adult coach should do this. Please provide the contact details of your teacher/coach in registration form
14. If you are using a chemical or tissue that you think might require specific safety and health guidelines, please do your research, ask your teacher/coach for instructions, and follow all safety guidelines.
15. Projects involving human subjects, human data or human testing are limited to the following: Use of data from preexisting, publicly available resources; Use of data from behavioral observations of unrestricted, public settings; Use of data received and recorded in an anonymous/deidentified format.
16. Projects involving animal subjects or animal data are limited to the following: Use of data from preexisting, publicly available resources; Use of data from observational or behavioral projects that involve animals in their natural environment or in an existing registered laboratory.
17. Projects involving biological agent subjects, biological agent data or biological testing are limited to the following: Use of data from preexisting, publicly available resources; Use of organisms recorded as being in Biosafety Level 1 (BSL1) and lower; Approved categories include; Baker's yeast and brewer's yeast, except when involved with DNA studies; Lactobacillus, Bacillus thuringiensis, nitrogen fixing, Oil eating bacteria, slime mold and algae eating bacteria introduced into their natural environment. Culture of bacteria or fungi within domestic areas is strictly prohibited. Culture where carried out must be in sealed petri dishes under appropriate supervision by professionals routinely engaged in biological agent culture, by participants with access to autoclaving facilities. Studies of mold growth on food items outside of a professional laboratory may only be allowed if the experiment is terminated at the first evidence of mold; Use of tissues are limited to the following: Plant tissue; Established cell and tissue cultures. Note: The source and catalog number of all cultures should be identified in the Research Plan.
No project may involve usage or handling of hazardous chemicals. THE USE OFCARCINOGENS OF ANY CATEGORY IS STRICTLY BANNED.

SCIENCE FAIR WEBSITES

1. **California State Science Fair:** Read about this science fair which has been going on since 1952! http://www.usc.edu/CSSF/
2. **Cyber Fair:** See sample fair projects, look through other student's examples, and see the steps involved in judging projects. http://www.isd77.k12.mn.us/resources/cf/welcome.html
3. **Experimental Science Projects:** Outlines steps in preparing a project (complete with an ideas list) and suggests the best ways to prepare one at different grade levels.
http://www.isd77.k12.mn.us/resources/cf/SciProjIntro.html

4. **Science Buddies:** Use the topic selection wizard to help you figure out what science projects interest you most. Once you have a topic, get help doing research, setting up the experiments, and completing them. http://www.sciencebuddies.org/
5. **Science Fair Central:** Includes cool project ideas, a science fair handbook, reviews of students' experiments, and more from Discovery Channel School. http://school.discovery.com/sciencefaircentral/
6. **Science Fair Project Resource Guide:** Samples, ideas, magazines, resources, and more. Includes a list of sites that explain the Scientific Method. http://www.ipl.org/div/kidspace/projectguide/
7. **Scientific Method:** Describes the five steps of the Scientific Method. http://school.discoveryeducation.com/sciencefaircentral/Getting-Started/Investigation.html
8. **Super Science Fair Projects:** Guide to projects the six steps of the Scientific Method. http://www.super-science-fair-projects.com/
9. **What Makes a Good Science Fair Project?** Short guide written by a group of experienced judges for the California State Science Fair. http://www.usc.edu/CSSF/Resources/Good_Project.html