



70th Annual Chicago Public Schools
STEM Exhibition

STANDING ON
THE SHOULDERS OF



2019-2020 Exhibition of Student **STEM** Research Information Update



NOTE: This is the most recent Science Fair Central presentation. The 2020/2021 Mini-Handbook PowerPoint can be found [here](#).

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Student STEM Exhibition Dates

- The City STEM Exhibition is March 19 - 22, 2020 with the Symposium presentation on March 19, 2020 and Opening Day on March 20, 2020.
- Illinois Institute of Technology will host the City Exhibition in 2020
- Regional STEM Expositions will be held in January 2020
- School STEM Exhibitions should be held prior to December 18, 2019
- Classroom presentations could be scheduled early to mid November



Please refer to the STEM Exhibitions Calendar of Events on the WWW.CSSF.ORG website for the most current dates, especially the due dates for any submissions that are marked with a #.

Students have been exposed to inquiry-based science/math instruction since the beginning of the school year and from instruction in previous years.



STEM Exhibition Categories

Aerospace Science ** (IJAS-Astronomy)	Chemistry	Engineering	Mathematics**
Behavioral Science*	Computer Science**	Environmental Science	Microbiology* (IJAS-Cellular & Molecular Biology)
Biochemistry*	Earth Science	Health Science*	Physics
Botany	Electronics	Materials Science (IJAS-Consumer Science*)	Zoology*

* Special rules apply for projects in this category. See the *2020 STEM Exhibition Handbook* (at cssf.org) about biological hazards and applying for appropriate endorsements:

- Request for Non-Human Vertebrate Animal Endorsement
- Request for Humans As Test Subjects Endorsement
- Request for Human or Vertebrate Animal Tissue Endorsement
- Request for Microorganism Endorsement
- Request for Recombinant DNA Endorsement

NOTE: For projects conducted in a university, hospital or research laboratory under the supervision of a Doctor, Professor or Scientist, endorsement(s) and supporting documents are due **October 25, 2019[#]. All other endorsements must be submitted in duplicate by **November 22, 2019**[#].**

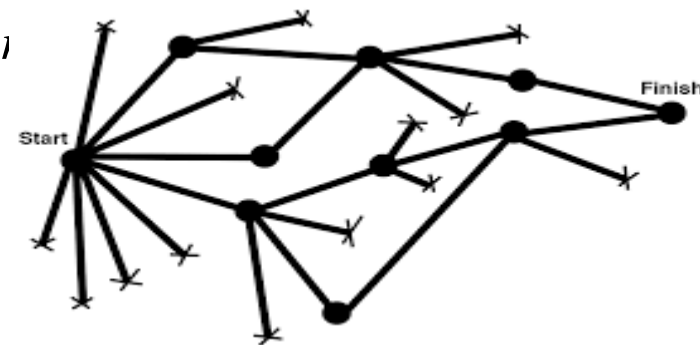
**** When a control group is not possible, a comparison among trials is acceptable.**



For the past several years there has been a new way to do STEM Research projects.

It is called a ‘Design Project’ where the student designs and tests a new product, algorithm, model or procedure.

For more details, see the handout entitled ‘A Comparison of the Scientific Method and the Design Process’ or pages 2-4 of the STEM Exhibition Handbook (cssf.org).



Assistance for Students

Advise-A-Student

This program is designed to assist students who have exhausted the help of teachers and parents. Upon receipt of an application demonstrating that the student has completed library research, the committee attempts to match the student with a research scientist who will provide expert help. The research scientist only offers suggestions on improving the project and should not be asked to provide equipment, laboratory space or funds.

Students will most likely communicate with the research scientist via phone calls or email. It is unlikely that face-to-face communication will occur.





Financial Assistance for Students

Mini Research Grant Program

Awards a maximum of \$100 per semester or \$200 per year to help finance the research of students in Grades 7-12. All equipment and supplies become the property of the school when the project is completed.

All grants are evaluated on the basis of scientific merit, scientific approach, and potential for further development. See suggested submission dates listed in the Calendar of Events (at cssf.org).





Financial Assistance for Students

Maxi Research Grant Program

Awards a maximum of \$500 to help finance the research of students in Grades 9-12. All equipment and supplies become the property of the school when the project is completed.

All grants are evaluated on the basis of scientific merit, scientific approach, and potential for further development. See suggested submission dates listed in the Calendar of Events (at cssf.org).





Scholarships mean MORE MONEY!

Scholarships are awarded to graduating seniors based upon STEM Exhibition participation, not financial need. This past spring over \$80,000 was awarded in STEM Exhibition scholarships.

If you are a senior and have participated in a Regional Networks or Citywide STEM Exhibition you should apply.

The application deadline is **March 27, 2020**#

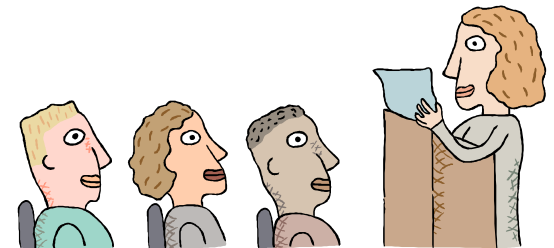




Stem Exhibition Workshops



- Workshops conducted by university professors for students, parents, and teachers; also a workshop to help students with data analysis
- CPS SSF workshops for Credentials Checkers and Safety Inspectors
- Workshops for parents
- Student STEM Exhibitions PowerPoint available on our website and Youtube
- Workshops for new science teachers and for school STEM Exhibition coordinators

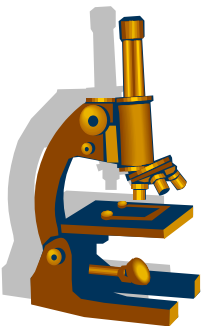


Project Planning and Selection

- Encourage students to explore an interest, a fascination, an idea that raises a question that would be stimulating to answer.
- A list of STEM Exhibition (Science Fair) Websites is provided
- Guide students to proceed with a **scientific** or **design** project:
 - decide on a **purpose**, or **problem**;
 - research the topic;
 - **formulate a hypothesis** or **establish a design criterion**;
 - **design an experiment** or **create a preliminary design**;
 - **Conduct the experiment** or **build and test a prototype**;
 - Collect and analyze data;
 - draw conclusions and/or **redesign and retest**;
 - write a research summary with a reference list using APA format. (APA Resources are also provided)

(See the flowchart handout or page iv at the beginning of the STEM Exhibition Handbook.)

ALL students should be strongly encouraged to perform and present some type of scientific independent study project even if it does not result in a STEM Research project.



Continuation of Projects

- Students who have participated in the STEM Exhibitions in the past may enter only the most recent year's research.
- This project year includes research conducted over a maximum of 12 months from April 2018 to March 2019.
- Any project in the same field of study from a previous year's project is considered a continuation unless the student clearly documents that there is additional research which is new and different from prior work (e.g. testing a new variable or new line of investigation, etc.).
- Repetitions of previous experimentation or increasing sample size are examples of an unacceptable continuation.



Exhibit Display Board

- The maximum dimensions of the display board are 61 cm (24”) deep, 107 cm (40”) wide, and 152 cm (60”) high.
- You can purchase three-sided display boards from: Showboard, Office Depot/Office Max, Staples, and at Science Fair Supply.
- The title of the project may contain **no more than 45 characters, including spaces.**
- Abstract (**now up to 250 words**), safety sheet and endorsements (if needed) must be posted on the front of the display board.
- **No lights of any kind may be displayed on the board.**
- **No stapling of anything to the display board.** Attachments to the board must be either glued or taped.



Estimating Experimental Error

- Science is all about measurement.
- Science can be defined as a system for measuring the world around you and drawing conclusions from those measurements.
- It is a fundamental scientific truth that no measurement is ever 100% accurate.
- Since there is always some error, it is important for students to understand where measurement errors are likely to occur.
- Measurement errors may come from the person doing the experiment, from variables, or from unidentifiable random error.
- In order to draw valid conclusions from measurement data, a student must understand how measurement error affects those conclusions.



Why are my results wrong? I measured everything with this ruler!



IJAS Essay Contest

State Essay

- **2020 IJAS Student Essay theme – “Revolutionizing Science”**
- **Chicago Essay Contest For Students in Grades 7-12**
- Same topic as the IJAS Student Essay.
- The top essays will receive cash awards.
- The first place essay will represent CPSSSF, Inc. at IJAS in May.

DUE DATE for all essays is **January 10, 2020#**



IJAS Cover Design Contest

- The theme for the IJAS cover design is “**Revolutionizing Science**” Students are to use an 8½” x 11” sheet of white paper and use only black ink. The design must include “Illinois Junior Academy of Science”. Keep the design simple.
- Entries are to be submitted to Luba Johnson by **December 17, 2019#**.
- The winning entry will be displayed at the State Science Exposition and the winning entry’s designer will receive a monetary award.





Guidelines for Judging Exhibits

- Regional Networks and schools are encouraged to use the criteria for judging as listed in the 2020 Handbook.
- Refer to the guidelines described in the *2020 STEM Exhibition Handbook* (at cssf.org). It is recommended that you send a copy of the judging rubric to your judges before the exhibition.
- Sources of judges include: scientists working in local research institutions, university professors who teach science courses, scientists from private industry, students enrolled in high school AP science classes, family doctors and other medical professionals, students enrolled in college or university science classes, retired science teachers, and the Army Corp of Engineers.
- Ask parents and students to suggest the names of individuals working in science-related careers to serve as a school or regional network judge.





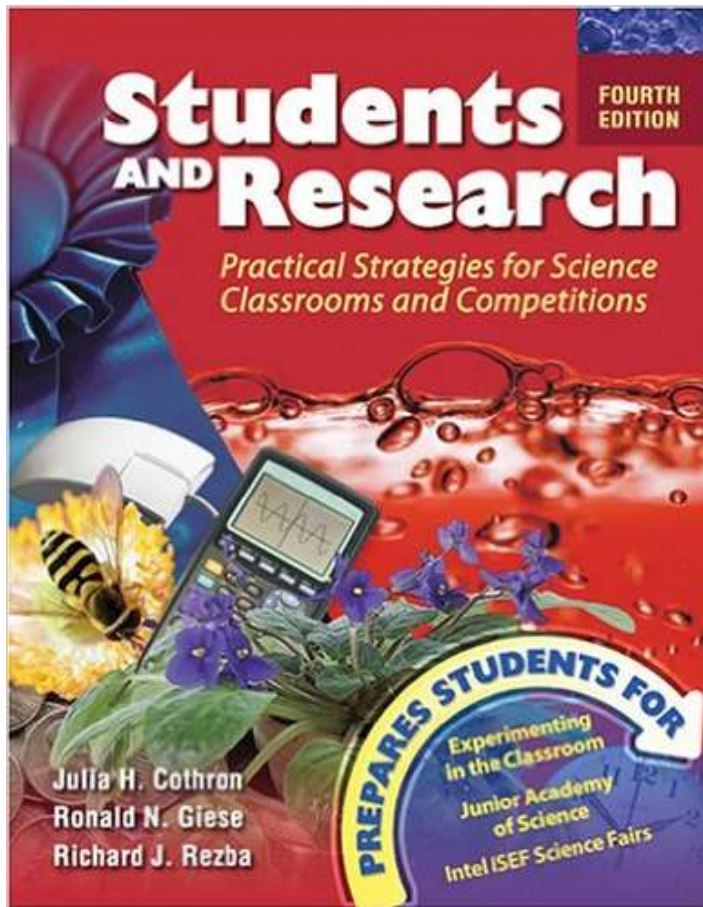
Misconceptions About STEM Exhibitions

- STEM Exhibitions are only for nerds—those smart kids.
- Teachers have to set time aside to teach *STEM Research*.
- Doing STEM Research projects is only an extracurricular activity and is beyond the Illinois Learning Goals.
- STEM Research projects are short-term assignments done overnight or over the weekend.
- Models and demonstrations make good STEM Research projects.
- STEM Research projects are best done by parents, older siblings, good friends, or professional researchers.
- Data can be collected and analyzed by ‘professionals’ and presented as the project.





Suggested Reference:



Cothron, Julia H., Giese, Ronald N., & Rezba, Richard J. (2006). *Students and Research: Practical Strategies for Science Classrooms and Competitions (4th ed.)*. Dubuque, IA: Kendall/Hunt Publishing Co.

ISBN: 978-0-7575-1916-1

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E-mail: orders@kendallhunt.com

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Safety Issues

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Safety is the watchword when developing a STEM research project.

Safety concerns are divided into two major areas:

- Review **Safety Guidelines for Experimentation** with your students during the planning stage of their projects. (pp. 10-22 in the handbook at cssf.org)
- Revisit the safety issue when your students start developing their presentation display by reviewing **Safety Guidelines for Project Display** (pp. 35-37) and **Rules and Regulations** (pg. 1) in the *STEM Exhibition Handbook* at cssf.org.

For IJAS and/or ISEF information, visit the following websites:

IJAS Policy & Procedure Manual at: <http://www.ijas.org> pp. 14-18

<https://student.societyforscience.org/international-rules-pre-college-science-research>



ALL projects must have a signed Safety Sheet

There are no exceptions to this rule. No matter how safe a project might be, we still want to teach students that safety issues must be addressed. Discuss with students the “safe” choices they made while working on their projects.

P.S. Don’t say “None” when a safety inspector asks what safety precautions you took.



SAFETY SHEET
The Illinois Junior Academy of Science

Directions: The student is asked to read the introduction carefully, fill out the bottom of this sheet. The science teacher and/or advisor must sign in the indicated space. By signing this sheet, the sponsor assumes all responsibilities related to this project.

Safety and the Student: Experimentation or design may involve an element of risk or injury to the student, test subjects and to others. Recognition of such hazards and provision for adequate control measures are just responsibilities of the student and the sponsor. Some of the more common risks encountered in research activities of electrical shock, infection from pathogen exposure, accidental reactions of unrecognizable chemicals, eye injury, fire materials or procedures, and fire in operation or work area. Considering these hazards and others with suitable controls is an integral part of good scientific research. In the sheet below, list the principal hazards associated with your project, if any, and what specific precautions you have used or will provide. Be sure to read the entire section in the Policy and Procedures Manual of the Illinois Junior Academy of Science entitled "Safety Guidelines for Experimentation" before completing this form.

Possible hazards	Precautions taken to deal with each hazard

_____ Please check off any other possible environments needed. Includes flow diagrams in your paper and on your board.
 _____ Disease or Test Subject - for any projects involving bioactive or toxic agents
 _____ Mix or explosion for any projects involving flammable, corrosive, toxic, fumes, fumes or pressure
 _____ Non-Hazardous Materials - for any projects involving fish, amphibians, reptiles, birds or mammals
 _____ Time or Culture for any projects involving growing cultures in tissue or cell culture
 _____ Biohazardous (DNA) must be conducted in a registered research laboratory under professional supervision
 _____ Use of Firearms - including all required documents
 _____ Letter from institution where research was done or IAS-SEC if an exception to the IAS rule has been granted

SIGNED _____
 Student(s) _____
 Sponsor *

*In a sponsor's absence all responsibilities related to this project. This sheet must be typed and this form must be displayed on the front of the exhibitor's display board. It may be reduced to half a sheet of paper, 8.5 inches (vertical) X 11.5 inches (horizontal) from a 6% reduction.



Research Labs

Any student working in a research lab on a project which may exceed IJAS human and non-human vertebrate guidelines must notify the Illinois Junior Academy of Science at least two weeks prior to the state exhibition.

Regional Winners!

Mail a copy of this letter to:

Illinois Junior Academy of Science
Scientific Review Committee
PO Box 268958
Chicago, IL 60626

This means anyone going on to the city exhibition must have on file a letter from their sponsor, on institution letterhead, stating that the student worked under supervision and followed all institutional guidelines regarding the ethical treatment of animals during research. This is IN ADDITION to the necessary endorsement forms.

NOTE: For projects conducted in a university, hospital or research laboratory under the supervision of a Doctor, Professor or Scientist, endorsement(s) and supporting documents are due **October 25, 2019#**.

Humans as Test Subjects

NEEDS
SIGNATURES

All projects involving humans must have an approved Humans as Test Subjects Endorsement signed by the designated committee member (see the form for details (pp. 63-64)).

An Informed consent form must also be kept on file. (see pg. 65 of the handbook at cssf.org).

If the project involves exercise and its effect on pulse, respiration rate, blood pressure, and so on, a valid, normal physical examination along with documentation from authorized school personnel must be on file for each test subject.

NOTE: **For projects conducted in a university, hospital or research laboratory under the supervision of a Doctor, Professor or Scientist, endorsement(s) and supporting documents are due [October 25, 2019](#)[#]. All other endorsements must be submitted in duplicate by [November 22, 2019](#)[#].**





Human or Vertebrate Animal Tissue Endorsement

All projects involving vertebrate animal tissue (human or non-human) must have an approved Tissue Endorsement signed by the designated committee member (see the form for details p. 71-72 at cssf.org).

NEEDS
SIGNATURES

This endorsement no longer applies to processed animal products.

However, be sure your safety sheet addresses the prevention of microbial growth (during and after) experimentation.

NOTE: For projects conducted in a university, hospital or research laboratory under the supervision of a Doctor, Professor or Scientist, endorsement(s) and supporting documents are due **October 25, 2019**[#]. All other endorsements must be submitted in duplicate by **November 22, 2019**[#].

Non-Human Vertebrate Endorsement

NEEDS
SIGNATURES

All projects involving live animals with bones must have an approved Non-Human Vertebrate Endorsement signed by both a licensed veterinarian **AND** the designated committee member (see the form for details pp. 67-68 (at cssf.org)).

Projects involving changes in an animal's normal environment will **NOT** be approved.

Working with
fertile eggs?

After 96 hours, stop
the experimental procedure
and destroy that set of eggs.
Start another trial with
a new set of eggs.

NOTE: For projects conducted in a university, hospital or research laboratory under the supervision of a Doctor, Professor or Scientist, endorsement(s) and supporting documents are due **October 25, 2019[#]**. All other endorsements must be submitted in duplicate by **November 22, 2019[#]**.





Microorganism Endorsement

NEEDS
SIGNATURES

All projects involving microorganisms must have an approved Microorganism Endorsement signed by the designated committee member (see the form for details pp.69-70 at cssf.org).

No more
'kitchen' cultures!!!

All microorganisms should be grown in Bio-safety level 1 laboratories (i.e. a school science lab).

Exceptions: Baker's
Yeast

Don't even think about culturing microorganisms from humans or other warm-blooded animals. These are strictly forbidden.

And don't grow anything outside of a laboratory.

NOTE: For projects conducted in a university, hospital or research laboratory under the supervision of a Doctor, Professor or Scientist, endorsement(s) and supporting documents are due **October 25, 2019#**. All other endorsements must be submitted in duplicate by **November 22, 2019#**.

For more information go to
www.science-projects.com/safemicrobes.htm

Recombinant DNA Endorsement

NEEDS
SIGNATURES

All projects involving recombinant DNA technologies must have an approved DNA Endorsement signed by the designated committee member (see the form for details p.73-74 at cssf.org).



NOTE: For projects conducted in a university, hospital or research laboratory under the supervision of a Doctor, Professor or Scientist, endorsement(s) and supporting documents are due **October 25, 2019[#]** . All other endorsements must be submitted in duplicate by **November 22, 2019[#]** .



**Alcohol
production?
Be sure to
check out
the new ATF guidelines
(pg.20 at cssf.org)**

**Only teachers can apply for permits
and the still has to be on school premises.**

**P.S. The application goes to
IRS- just to be sure you're
not supplementing your
teacher's income.**

Students MUST obtain permission from the Scientific Review
Committee BEFORE beginning their investigation.





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Lasers and Drones

Lasers and drones **MAY** be used in a STEM Research project provided ALL Federal, State, Local and STEM Exhibition laws, regulations and rules are obeyed and clearly addressed on the Safety Sheet **AND** in the Procedure section of the research paper. See pages 17-20 of the *STEM Exhibition Handbook*.



ACHOOO !

Leave your mold at home.

Speaking of humans, animals, plants and microorganisms; leave them all at home. You are not allowed to display any living things.



Pseudomonas



Streptococci



Salmonella typhi



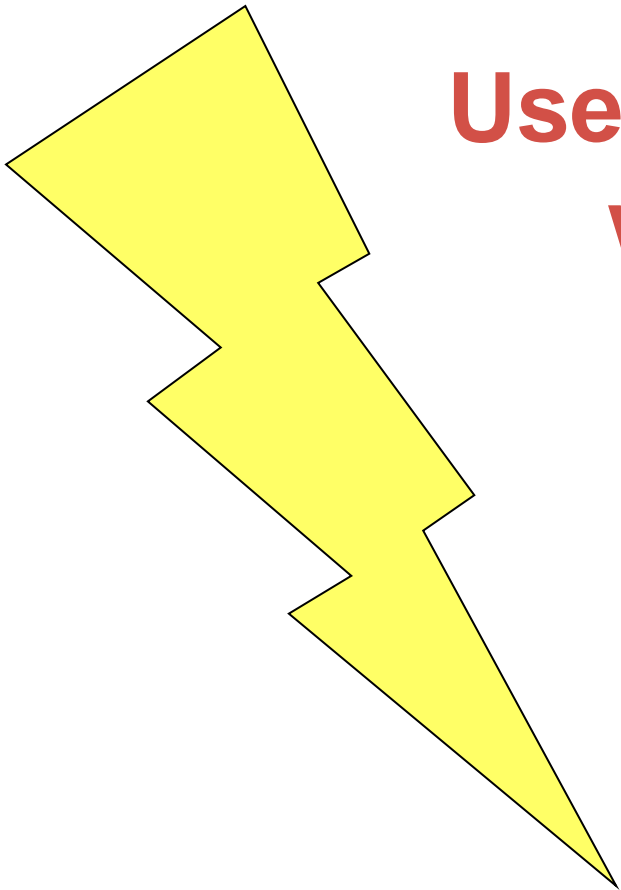
Salmonella typhi





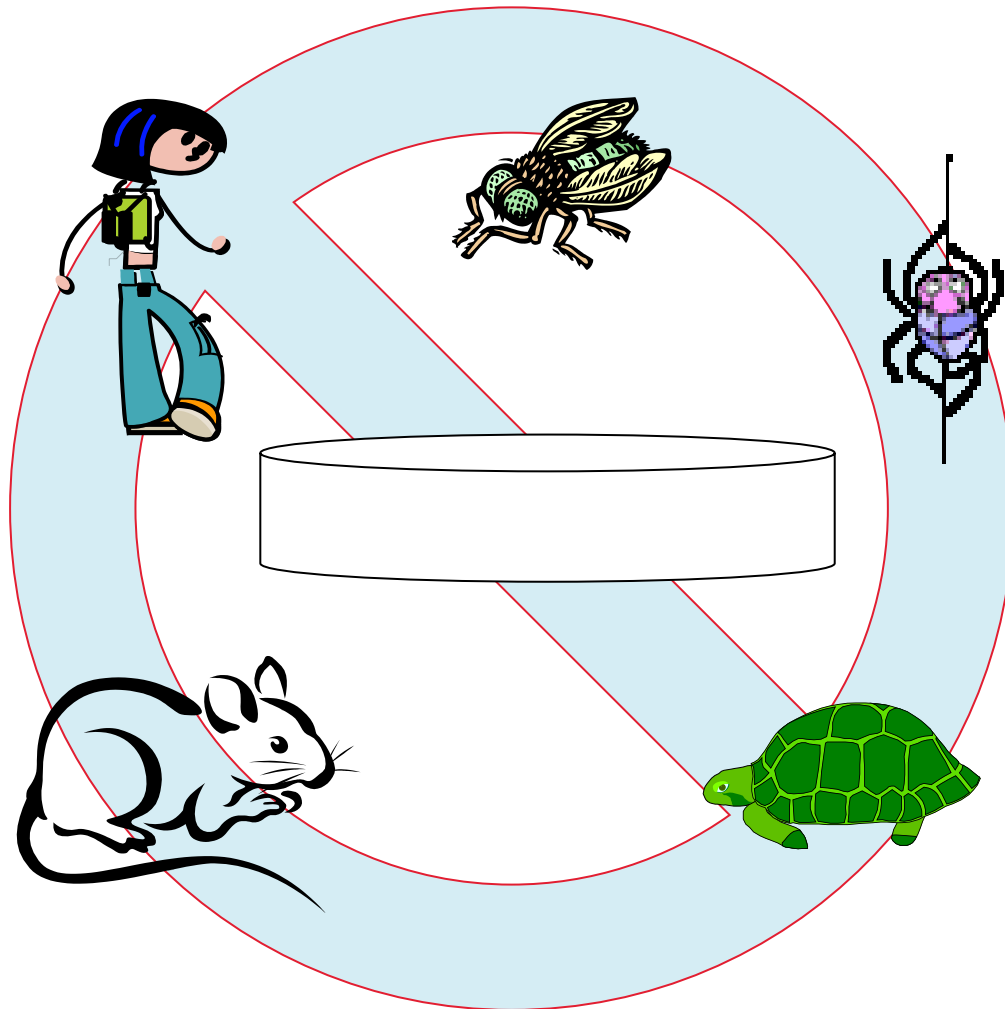
Electrical Projects

**Use batteries
whenever
possible**



However, if you are going to use a laptop, be sure to have your battery pack charged. There will be NO electrical outlets for laptops.

DO NOT DISPLAY



Hazardous Materials

Can be used in experiments (if handled properly and safely) – but are not to be displayed at the exhibition.

NO matches.

NO open flames.

NO electric heaters.

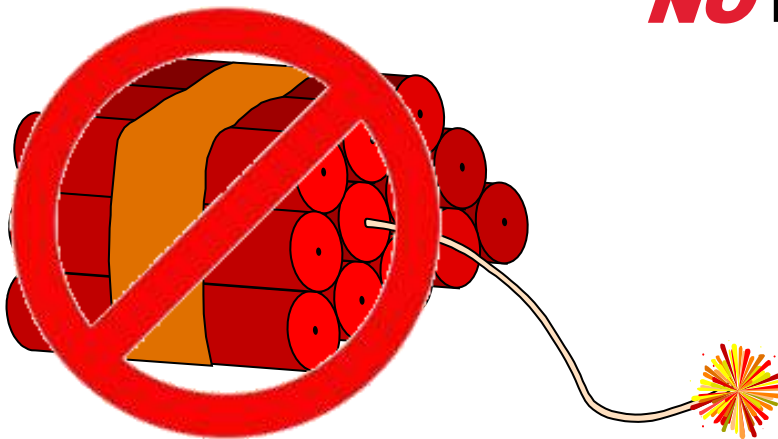
NO lasers

NO chemicals.

NO compressed gas cylinders.

NO radioactive materials.

NO firearms or explosives



Ordinary home chemicals and supplies can be used in experiments (if handled properly and safely) – but are not to be displayed at the exhibition.

NO salt,
NO sugar,
NO water,
NO food coloring,
NO chemicals will be allowed on display.

NO
means
NO



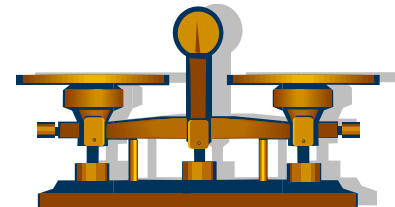
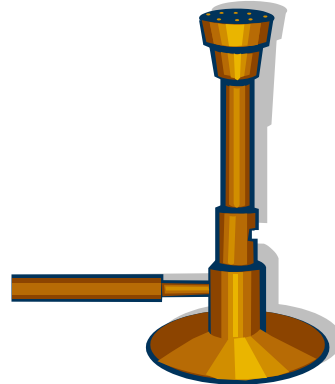
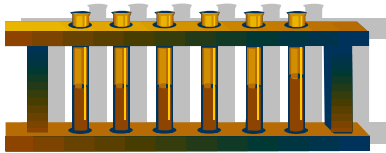
The only things that may be displayed on the table is your Display Board and a computer.





Laboratory Apparatus

Judges know what beakers, graduated cylinders, balances, thermometers, etc. look like — leave them at school.





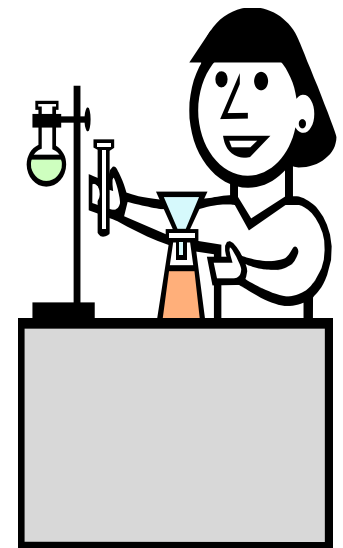
**Judges Love
Photographs**

It is suggested that you have at least one photograph of you **doing** your experiment posted on your board or available at your display. Make sure safety precautions are evident in your picture.

Note to students:

You have completed your project at home. You are not coming to the STEM Exhibition to do an experiment, you are coming to communicate your Results and Conclusions with the judges. **The only things that may be displayed on the table is your Display Board and a computer.** Show your charts, graphs, pictures, drawings, explanations, and other information on the display board or on the computer. **Power point presentations are NOT allowed.** No outlets are available, therefore, computer batteries must be charged.

Remember, this is **Tell** - not *Show and Tell*.





Websites:

Chicago Public Schools Student Science Fair, Inc.:

www.cssf.org

Illinois Junior Academy of Science: www.ijas.org

International Science and Engineering Fair:

student.societyforscience.org/intel-isef

People you should know:

Carrie, Kaestner, Chairperson 2019/20 – cjkessinger@cps.edu

Elizabeth Copper, Advise-A-Student – escopper@cps.edu

Elizabeth Copper, Scientific Review – escopper@cps.edu

Pamela Little, Safety Chairperson– pamelacs@comcast.net

Luba Johnson, Communications/Publications – ljohnson131@cps.edu

Thank you for being here and participating.

Be good, be safe and, above all, have fun with

Science, Technology, Engineering and Mathematics!

