

MSEF

Massachusetts Science
+ Engineering Fair



MIDDLE SCHOOL MANUAL

The Massachusetts Science & Engineering Fair program gives students the chance to engage in science and engineering discovery through hands-on experience. Through the Fair process, students learn about emerging fields of science and engineering, while developing important academic and life skills - from reading, writing and math to communication, teamwork and design.

Engaging in an independent research project via the Fair program provides a solid foundation to support development of scientific thinking while providing context and practice to the skills and standards students explore in the classroom.

The Middle School Science and Engineering Fair Structure

All Massachusetts students in the 6, 7, and 8th grades are eligible to enter the statewide middle school science fair program. This is most often facilitated through their school's science department, but can be pursued through an afterschool program or homeschool setting.

Students may work on their project individually or as part of a team of two or three members.

Regional Science Fairs are held across six regions determined by the location of the student's school/site. Students with the top projects from each region may participate in the MSEF State Science & Engineering Fair. In addition, each middle school may send a set number of projects to the State Fair.

Click on this link for participation information, <http://scifair.com/fairs>

Science & Engineering Fairs have rules, suggested procedures, and expectations to support student learning, keep participants safe, and provide consistency across schools and programs. Familiarizing yourself with this manual is the first step in your Science & Engineering Fair participation.

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The Science & Engineering Process

The most critical aspect of a project is the way the student explores and manages the project. A simple project can offer a great experimental challenge to the imaginative student. The role of the teacher, mentor or parent should be one of guidance, encouragement and, as needed, constructive criticism. In some cases, supervising a safety-related component of the project will be required.

Visit the scifair.com website for more information and resources

OBSERVE: Choosing a Project

Student projects should be of an experimental nature –either investigating a research question or solving a design challenge. The main areas for evaluation are the scientific or engineering design approach, the thought processes used in completing the project and the student’s mastery of the topic and concepts. The strongest projects are often driven by student interest and what is personally meaningful to them. These can help in choosing:

- Brainstorm ideas by generating questions after experiencing a phenomenon, reading an article or watching a video.
- Have students think about local or global issues that matter to them and what they could research or design that can help their community.
- Have students identify careers in STEM that interest them and explore possible connections.

PLAN: Research and Design

The next key step to planning a project is determining your ‘testable question’ or the ‘problem to solve’. It needs to be something that can be observed and measured. Something that can be answered or solved in the time available through experimentation or design and testing.

Once you know what you want to address with your question or problem, you need to determine how you want to address it. This is your research or design plan, where you identify what is feasible in the timeframe, what materials you need and the process you need to follow.

EXPLORE: Experimentation and Investigation

Students will need to experiment and investigate according to the plan they devised in the previous step. This may involve creating their prototype, testing, and revising and conducting multiple trials with different conditions and variables. Data collection and recording observations is critical in this step and we encourage students to do recording by hand in a *project notebook*. This simulates the experience of scientists in a lab and reinforces a student’s processing and understanding. In this phase it is important for students to know how to ask for help and learn from the unexpected.

EXPLAIN: Communication and Presentation

Once data and observations are collected, students must analyze and interpret their findings. They should represent their findings and tell the story of their project in a few different ways. Students will need to create graphs & tables, written reports as well as poster presentations that summarize the key pieces of their project and discovery.

Students also will need to present their work through oral communication with a practiced presentation as well as prepare for Q&A with judges and volunteers.

The Science & Engineering Project: Requirements and Recommendations

zFairs: Online Platform

All Middle School Regional Fairs use zFairs to have students create an account to upload forms for safety review process. Each Region has their own zFairs site for students to register and upload the appropriate forms.

We recommend that students draft their research plan (form 1B) before creating an account.

Teachers need to register first and then students can set up their own account to register. The forms will need to be downloaded, filled out and then uploaded for SRC (Scientific Review Committee) approval through zFairs. Regional zFairs websites are listed on scifair.com/fairs

For more information on student registration using zFairs refer to this [Student Guide](#).

Requirements

- ⇒ Projects should only include research done in the current school year to be eligible for participation at the Middle School level.
- ⇒ Individual projects must be entirely the work of the individual student and team projects (up to 3 students) must be entirely the work of the team.
- ⇒ Required forms must be submitted to the Regional Scientific Review Committee for approval BEFORE starting experimentation.
- ⇒ Students are required to keep a bound logbook with original, handwritten and dated entries to record each step taken in the development of the project. A composition notebook works well.
- ⇒ Students must have a final lab report, complete with works cited. This should include all the steps of the scientific method or the engineering design process.
- ⇒ Students must have a visual display prepared for presentation at the Fair.

Due before the start of experimentation

The following forms must be uploaded to the student's Middle School Regional zFairs account:

- **Forms 1A and 1B** : Research Plans are required for ALL PROJECTS
- **Form C**: Human Informed Consent Form that will be given to subjects before experimentation, if applicable
- **Form D**: Designated Supervisor Form, if applicable

Student must retain a copy of any/all forms.

All Forms and PDFS must be uploaded to zFairs prior to regional and state deadlines as posted.

If you won at a regional fair, you will automatically be promoted to the state fair and no additional paperwork is needed on the student part. Please remember to check email as all correspondence is done via email to teacher, student and parent.

Research Plan (Form 1A and Form 1B)

Forms:

Prior to beginning a research project for a regional or state science fair, each student is required to complete a Research Plan (**Forms 1A and 1B**)

Group projects still require submission of individual student forms from each student

Some projects may require additional forms:

- *Form C is required if the project involves human subjects*
- *Form D is required if a project requires a supervisor*

Forms can be found on the zFairs portal and in the Resources section of scifair.com. They will need to be downloaded to complete. Once completed, required forms are uploaded to the Regional zFairs portal for approval.

Approval:

Students participating in the science fair process **MUST** get **prior approval before starting experimentation**. This prior approval **MUST** come from the Regional Middle School Scientific Review Committee (SRC).

Students will be notified via zFairs about approval status within 10 days. Any project that has not received approval by the SRC will not be eligible to compete at the Regional or State Level.

Review the list below (page 6) of what will NOT be allowed in any project.

You may contact your region or MSEF at anytime when completing the forms to ask for clarification on rules or process before submitting.

Common Sense to Avoid Risk:

Thinking about risk goes beyond using hazardous materials and tools. You should consider the materials used and the method that are used in collecting data to ensure student and community safety.

Middle School Research Regulations

FORMS 1A & 1B MUST BE FILLED OUT AND UPLOADED TO REGIONAL ZFAIR WEBSITE FOR REVIEW. Forms C & D should be filled out if project requires it.

Projects that require Forms C & D and/or include remote animal observations MUST BE SUBMITTED AND APPROVED BY THE SCIENTIFIC REVIEW COMMITTEE PRIOR TO STARTING THE EXPERIMENT!

Projects that begin experimentation before receiving pre-approval will be disqualified.

FORM C:

All human research projects must have an Informed Consent Form (Form C) submitted.

- Human Research projects are only allowed with minimal risk and anonymous data collection and if it is one of the following:
 - Research involving normal educational practices
 - Research on individual or group behavior or characteristics of individuals where the researcher does not manipulate the subjects' behavior and the study does not involve more than minimal risk.
 - Surveys and questionnaires that involve perception, cognition, or game theory and do NOT involve gathering personal information, invasion of privacy or potential for emotional distress such as sensitive personal history, physical or mental health.
 - Studies involving physical activity where the probability of harm is not greater than those ordinarily encountered in DAILY LIFE or during performance of routine physical activities. For example, activity conducted in Physical Education class.
- All human research projects-- including surveys, professional tests questionnaires, and studies in which the human subject used is also the researcher -- require Regional Scientific Review Committee (RSRC) approval. Copies of standardized and/or student prepared tests, surveys, etc. to be used must also be uploaded to zFairs for approval.
- After approval, Informed Consent Form (C) must be signed by all subjects involved in human research projects prior to the experimentation, with the exception of anonymous surveys. Copies of all signed Informed Consent Forms must be uploaded to zFairs to enter the MSSEF statewide Science Fair. If a participant/human subject is under 18 years old, the parent/guardian signature is required.

FORM D:

Experiments with non-pathogenic microorganisms*

All projects with non-pathogenic microorganism must have a Designated Supervisor Form (Form D) completed and submitted for RSRC approval before experimentation.

All projects with any non-pathogenic organisms may only be conducted in a laboratory setting (not in the home):

- The laboratory work is to be supervised by an individual with general training in microbiology.
- Standard practices for sterile technique must be observed.
- Work is to be done on an open bench or fume hood.
- Purchased microorganisms must be identified and certified as non-pathogenic from the supply house with full name of microorganism, source of purchase and catalog number. E. coli K-12 is a great example that can be purchased through Carolina Biological.

- Lab coats must be worn.
- Culture plates/tubes of bacteria must be sealed and not opened in the laboratory after culturing and growth.
- Sub-culturing is not allowed.
- Decontamination must be achieved by either chemical disinfectants or steam autoclaving.
- Baker's and Brewer's yeast do not need Form D. *The only two exceptions.

Special Safety Concerns: Other situations such as use of power tools, chemicals, etc. will require adult supervision of the middle school student's project and need to be documented on Form D, Designated Supervisor.

Middle School Students' Science Fair projects may not involve, at any stage of the project, the following:

- Blood products, fresh tissue, skin, teeth or bodily fluids.
- Nonhuman vertebrate animals and their parts. The only exception to this is unfertilized egg shells. (See note below about observation projects.)
- Ingestion, absorption or inhalation of any substance by human subjects (no smelling/wafting or eating/chewing of ANYTHING)—NOTHING in or on parts of mouth or skin—including, but not limited to, teeth, tongue, and lips.
- Pathogenic agents*
- Recombinant DNA
- Carcinogenic or mutagenic chemicals
- Compressed gas (exception: helium, CO₂, air, purchased for home use)
- Controlled substances*
- Explosive chemicals
- Hazardous substances or devices (including, but not limited to BB guns, paint ball guns, potato cannons, air cannons)
- Highly toxic chemicals
- High voltage equipment
- Lasers (any strength) exception: infrared thermometer with Supervision Form D
- Ionizing radiation X-rays or nuclear energy
- Radioactive materials
- Composting

*** FURTHER EXPLANATIONS:**

Controlled Substances including DEA-classed substances, prescription drugs, alcohol and tobacco are not allowed.

Pathogenic Agents are not allowed

- ⇒ Pathogenic agents or disease causing, or potential disease-causing organisms such as bacteria, viruses, viroids, prions, rickettsia, fungi, mold, and others.
- ⇒ Organisms collected, isolated and/or cultured from any environment (e.g., air, soil, water) considered potentially pathogenic and experiments using these procedures.
- ⇒ All plant projects must use sterile, bagged potting soil.
- ⇒ Raw or partially processed human/animal waste is considered to contain potentially pathogenic agents.

Vertebrate Animal Remote Observation Projects

Manipulation of an environment or interaction with animals in any way, requires a rigorous review process

with animal care professionals in addition to preapproval from regional committees and completion of special forms. MSEF does not allow the completion of projects with this scale of research at the Middle School level in Massachusetts.

Animal safety and unintended interference is our top priority, so we have set parameters for potential animal science projects with the intent to allow exploration safely and ethically to support student engagement.

What can be considered:

- Zoocams or Naturecams from regulated organizations such as Audubon, State Conservation Departments, National Parks, etc
- Observation in [AZA Accredited animal care facilities](#) (zoos, aquariums, wildlife parks)
- Data mining/analysis of animal data from research institutions
- Data mining/analysis from authorized citizen science projects (see iNaturalist, Zooniverse, Scistarter for ideas)

What is not allowed:

- There can be no interaction with the animals being observed.
 - This includes touching and verbal interaction.
 - This includes any in-home observation of domestic pets
- There can be no manipulation of the animal's environment in any way
 - This includes changing food sources, limiting movement with gates, introducing sounds or smells.
 - This includes any recording equipment like trail cams
- There can be no interaction with any animal parts, fluids or excrement.
- The study meets all federal and state agriculture, fish, game and wildlife laws and regulations.

The student's research plan should clearly state why they are taking this approach, alternatives they considered, and a description of procedures and safeguards to ensure no interaction or interference with the animal. **These forms MUST be preapproved by Regional SRC before beginning any experiment.**

Please contact klebeau@scifair.com for any questions about these parameters.

DAY OF FAIR: Guidelines and Expectations

GENERAL REQUIREMENTS

- Students must remain with their projects during judging and exhibition times.
- Parents, advisors, mentors, teachers and guests must wait outside the project area until public display begins.
- Cell phone use is not allowed during the judging period. Students should be ready to engage with the judges and guests in a professional manner.
- When a student is accepted for the State Fair, the student, teacher, and parent will receive additional fair information via zFairs.

PROJECT DISPLAY GUIDELINES

The purpose of the science fair is to explain the research, through the safe use of materials, through photographs, videotapes, charts, diagrams and other simulations. It is not to demonstrate the experiment to the judge.

Students must adhere to all display guidelines provided in this Manual. If the State Safety Review Committee considers the presence or operation of any equipment or material to be dangerous or unsafe, it has the right to prohibit the presence or operation of such equipment or material.

All Science Fair participants must adhere to the safety aspects of their projects as follows:

- Projects must fit on a 40" x 26" table space. Wall space for posters is not available. Students must design their exhibits so that all posters, charts and displays are free standing.
 - Due to the popularity of projects needing electricity, these projects will get less than 40" depending on amount of projects
- No aisle space for project displays is allowed
- No laser pointers allowed.
- Glass is prohibited from display area but may item(s) be either encased in a break-resistant container or replaced by a break-resistant container. The exception is glass light bulbs. Mercury thermometers are prohibited.
- Water and saline may be displayed in a sealed plastic container but no other liquids can be displayed.
- Knives and other sharp objects may not be displayed.
- Microorganisms may not be displayed.
- Drugs, over-the-counter medications, antibiotics, and vitamins may not be displayed.
- Access to electrical outlets is limited, so please bring a heavy-duty/three-pronged extension cord.
- The power supply cord for electrical apparatus must terminate in a three-prong grounded outlet.
- Form C (Human Consent Form) should be in a separate notebook, not displayed on the table, should the safety judge ask to see it

What to Expect from Judging

The judging process will focus on what the student has learned about his or her chosen project and the process used in completing the project. In addition, the project will be judged based on the student's ability to discuss the overall scope and significant results of his or her work. Judging criteria for team and individual projects are identical.

1. Scientific or Engineering Approach - Possible 25 points

- A. Did the student start with a clearly stated hypothesis or statement of an engineering goal?
- B. Was the student orderly and logical with the setup and follow through of the project?
- C. Were the student's conclusions consistent with the data he or she collected?

2. Knowledge of Project Area - Possible 20 points

- A. How effectively did the student conduct preliminary research?
- B. What was the extent of the student's knowledge of material related to project?
- C. Was the student aware of both the scope and limitations of the project?

3. Thoroughness - Possible 20 points

- A. Did the student do sufficient research in the literature before starting the project?
- B. Was thorough use made of data and observations?
- C. Was the original plan successfully followed through to completion?

4. Written Records and Reports - Possible 15 points

- A. Did the student keep an original handwritten, bound logbook with all plans, procedures, observations, and conclusions for failures as well as successes?
- B. Did the student put together an accurate written report, complete with work cited?

5. Ingenuity and Creativity - Possible 15 points

- A. Was the explanation of the project clear and precise?
- B. How well did the student use his or her materials in the solution of problems?
- C. Did the student present any new unique ideas?

6. Visual presentation - Possible 5 points

- A. Was the project displayed in a logical and organized manner?
- B. Did the display and posters effectively convey the message in an understandable manner?

Middle School: Frequently Asked Questions

Do teachers have to register before students can submit paperwork on zFairs? Yes, a teacher must register so that when students fill out the forms the school and teacher name is available as a choice to select on the zFairs platform.

How do I know in what region my school is located? [Here's a list](#) of the six regions and the towns included in each one.

Once I know what region my school is in, how do I find the contact information for the regional chair and when the regional fair will take place? Find information on the six Regional Fairs, including contact information and fair dates, at www.scifair.com/fairs and click on the Region link for your town.

When does the paperwork for project approval need to be submitted? After the teacher makes an account, project paperwork for SRC (Scientific Review Committee) must be submitted by regional deadlines.

Are any approvals needed before beginning projects? Yes, research plans (Form 1A & 1B and C & D if necessary) need to be approved by the Regional Scientific Review Committee to be sure that the proposed project follows all safety rules. If promoted to the State Science Fair, the project will be checked again for safety. These forms will all need to be downloaded, then uploaded with signatures, to zFairs.

Can a parent be a designated supervisor (Form D)? Yes, at the middle school level, a parent may supervise a student's project if the parent has the expertise to do so.

How do I know if a student's project has been approved? Teachers and students will receive an email once SRC has approved the project. Students can also log into zFairs to check on status.

What can I do if my school does not have a Fair program? You can still participate if your teacher will review and sign all the necessary forms for you to register for your Regional and State fairs. Remember you will be responsible for understanding all the safety rules, deadlines and for making sure all required forms are submitted on time. You and your teacher will still need to set up accounts in zFairs.

How do students who placed at the Regional fair get entered into the State fair? The top projects from the regional fair will automatically be promoted as a State Fair participant via the zFair platform and information will be sent about the details of the State Fair. Each school can additionally send one direct entry to the state fair. Please inform your regional chair about a direct entry so they can promote to the state fair.

What is the Broadcom MASTERS? The Broadcom MASTERS ("Math, Applied Science, Technology, Engineering Rising Stars") is a national competition for the top 10% of winners from all middle school regional and state fairs. Students with qualified projects receive a certificate and information about submitting their projects online. It is the student's responsibility to submit their project by the deadline. You can find out more about Broadcom MASTERS by going to the [SSP website](#).

What are the materials required to be judged at MSEF?

- Display Board (you can upload your PDF or slides to zFairs but a project board must be displayed at the fair)
- Project Report with work cited
- Bound project notebook: hand written or electronic

Do I get less space if I need electricity? Yes. This is due to the limited number of outlets and the layout of the exhibit hall. We suggest charging computer laptops before you arrive, if that is the only reason you need to have electricity access.

Why are there two sets of safety guidelines? One set of safety guidelines refers to the time during which you are doing your experiment. The other set of safety guidelines refers to what you can bring the day of the science fair as part of your project display. Some of the guidelines overlap, but there are differences, so be sure to look at both sets. On the day of the science fair, there will be safety checks of all projects before the judging takes place.

Are there any restrictions on what I can bring the day of the state fair? Yes, there are some that are due to space limitations, to restrictions of the venue and for safety at a public event. You can find a list of prohibitions [here](#).

PROJECT SAFETY and MATERIALS:

Where are the safety rules for project work? Look in this manual, page 3 through page 7

Are “human consent” forms necessary even if the student is just observing people for the experiment? Yes, the people you are observing need to give their permission to be observed, even if they might not be aware that you are doing it. If you observe people who are under 18, you need to have their parent/guardian sign the Human Consent Form.

Can I use any rating level of video game, movie/video clip/music in my experiment? No. The ratings must be appropriate for middle school student experimenters and their subjects. The following ratings are the only ones that can be used:

- Video/clip – C, E, or E+
- Movie – G or PG
- Music – The title, lyrics and artist must be submitted for approval prior to beginning the experiment.

Can we use compost in an experiment? No. There is a possibility that the experimenter may unknowingly cultivate harmful microorganisms that could cause disease or allergic reactions.

Can I observe food spoiling under different conditions? No. There is a possibility that the experimenter may unknowingly cultivate harmful microorganisms that could cause disease or allergic reactions.

Can I do an experiment to find out if there are bacteria on doorknobs, countertops and bathroom surfaces? No. It is not safe to grow bacteria from either an inside or outside environment. The reason for this safety rule is that the bacterial or other microbial species is unknown and could be disease causing, thereby posing a health risk for the experimenter.

Is it OK under the safety rules to do experiments about chewing gum since gum is not swallowed? No, any experiment that involves putting anything in the mouth, on the tongue or teeth is not allowed.

What soil can I use for planting projects? Because of the potential of pathogenic agents, only bagged, sterile potting soil may be used. Not all potting soil is sterilized so make sure you look for that on the label.

For Further Information

Massachusetts State Middle School Science & Engineering Fair

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