



2019 E³ Engineering and Technology Fair

Engineering, Exploration, and Experimentation

Monday, March 25, 2019 Clark Gymnasium at RIT
9:00 am to 1:00 pm

General Chair

Steven Day
ASME, RIT 585-475-4738
swdeme@eit.edu

Schools Contact Chair

Adelaide Svoboda
Retired Naz. Coll., 585-442-8386
ajsvodod@gmail.com

Design Contest Chair

Jayanti Venkataraman
IEEE, RIT, 585-475-2143
jnveee@rit.edu

Fund Raising

Satish Kandlikar
ASME, RIT, 585- 475-6728
sgkeme@rit.edu

RES Liaison

Jon Kriegel
ASME, 585-281-5216
jkriegel@rochester.rr.com

Booths

Richard Repka
IEEE, 585-533-2308
rrepka10@gmail.com

Facilities

Gill Tsouri
IEEE, RIT, 585- 475-6452
grteee@rit.edu

Web Master

Bruce Nelson
IEEE, 585-857-9144
Bruce.nelson@ieee.org

Panos Markopoulos
IEEE, RIT, 585-475-7917
pxmeee@rit.edu

School Outreach Liaison

Morton Stein
scidoc@rochester.rr.com

Administrative Director, RES

Lynne Irwin
585-254-2350
RES@frontiernet.net

The E³ Fair Committee is pleased to announce the 27th annual **E³ Engineering and Technology Fair**. The first E³ Fair was held in 1991 and, consistently through each year, it continues to be organized and funded by a joint effort between engineering societies and area industries. The Fair's mission is to increase exposure of engineering and technology related fields (those known as **STEM** – Science, Technology, Engineering, and Math) to middle school students (grades 6 – 8). Students learn the importance of team and process concepts while they are preparing engineering and technology projects which include communicating and making a plan for success. It also allows for creativity and independent thinking. In addition, students learn about careers in engineering from professional engineers at the Fair.

The E³ Fair is from 9am to 1pm with student competitions starting at 9am. When students are not involved in their competition, we encourage them to visit the booths where local engineering societies, colleges and industries will engage students with demonstrations of technology. Students will be eligible for a prize if they visit a designated number of booths.

There are three competition options available to students:

Science / Engineering Project (Option 1): Prepare a project or experiment for display that is based on engineering or technology principles.

Simple Machine (Option 2): ‘Stationary Power Lift’ Design and construct a machine, using only parts from a Lego kit (model number specified by the E3 Committee), capable of vertically lifting a basket of weights to a height of 4" in 30seconds.

Robotics (Option 3): Design, construct and program a robot, using parts from a LEGO kit (model number specified by the E3 Committee), capable of removing coke cans out of a circular playing field in as short a time as possible.

The Guidelines for the competition are available on the E3Fair website.

Middle schools in Monroe County and surrounding counties participate in the E³ Fair. If you have participated in past Fairs, we hope to see you again. If you have not previously participated, join in – you will not be disappointed. It is a rewarding and fun experience. Please do not hesitate to contact us with any questions or comments.

Sincerely,

Steven Day, General Chair
Adelaide Svoboda, Schools Contact Chair
Jayanti Venkataraman, Design Contest Chair

VISIT OUR WEB PAGE - www.e3fair.org

OPTION ONE

GENERAL DESCRIPTION

Projects submitted for Option One will consist of full-size or scale models of a physical structure or device, a detailed description of a process, device, or structure, or data obtained from a project involving experimentation. The presentation of the project at the Fair may include posters, photographs, written work as well as any actual device that may have been constructed. The project and any other supporting data or displays will be placed on the table space assigned to the entrant. This space is limited and the physical dimensions of each entry must not exceed three feet (3 FT) in height, width, or depth; nor may it exceed 30 pounds in weight.

For each grade level, the following topics are suggested to provide a thematic background to the Fair. These suggestions are not intended to limit the students. These are topical areas of wide interest technologically and serve as useful guidelines for the students. If a team of students cares to choose a topic not listed, they may do so at the discretion of the teacher/advisor.

OPTION ONE *Suggested Topics*

A. ENGINEERING THE ENVIRONMENT

- forms of energy and energy utilization
- preserving our environment; waste disposal and recycling, product packaging
- protecting our atmosphere; global warming, ozone
- how humans and technology impact the environment

B. ENGINEERING FOR EXPLORATION, TRANSPORTATION & COMMUNICATION

- land, sea, air, and space
- communication and communication systems
- robotics, telepresence
- computers and computer technology

C. ENGINEERING FOR HEALTH AND BIOTECHNOLOGY

- genetic engineering
- artificial organs or limbs, medical devices
- food production, processing, storage
- new and novel ways of growing food

OPTION 1

PARTICIPATION AND EVALUATION GUIDELINES

1. The Option One project and all associated presentation materials will be displayed on a table at the Fair. The total physical dimensions are limited to 3ft long x 3ft deep x 3ft high and a maximum weight of 30 lbs.
2. Each group should bring a sign (approximately 30" x 8") displaying the title and grade level. An example for Grade 6 is shown below. This will be taped to the table on which the project is displayed.



3. Students participating in Option One must work under the guidance of a teacher or advisor.
4. Students currently in the 6th, 7th, or 8th grades are eligible to submit a project to the E³ Fair. Those participating may consult any resource at their disposal during the design period, however all hands-on work must be done by the group members.
5. Option One projects may not contain any projectiles or flammable fuels of any sort. This includes but is not limited to gasoline, kerosene, and any acids or bases. The use of electricity is permitted and 120V power will be provided if requested on the Option One Registration Form.
6. Projects that have been part of a classroom activity or another competition or Fair, may be entered by the group that designed and built them.
7. Members of a team must belong to the same grade level.
8. The maximum number to a team is four students.
9. There is no limit to the number of eligible student groups that may participate in Option One of the E³ Fair from any one school.
10. A Judging Committee will determine the winners in each grade level of each category.

Note: For questions / clarifications of the rules, please contact the Chair of the Design Contest Committee.

OPTION TWO – STATIONARY POWER LIFT

GENERAL DESCRIPTION:

Option Two involves an open-ended, hands-on, problem solving activity. Participants will solve the problem, build their solution, bring their solution of the problem to the Fair and participate in a competition.

PROBLEM STATEMENT:

Design and construct a machine, using only parts from a Lego kit (model number specified by the E3 Committee), capable of vertically lifting a basket of weights to a height of 4” in 30seconds. The machine will be placed on a platform provided by the E3 committee, Figure 1, and must support itself without falling over while connected to the basket. The basket (also provided by the Committee) will be placed with its center 3 inches from the nearest edge of the platform. The machine must raise the basket, with an amount of weight selected by the competing team, vertically to a height of 4 inches within 30 seconds of beginning the lift. Flat washers, 3/8 inch in diameter, will be used for the ballast weight within the basket. The basket itself will be a 4-inch diameter, PVC cup with strings converging to a singular point for attachment to the participants’ vehicle.

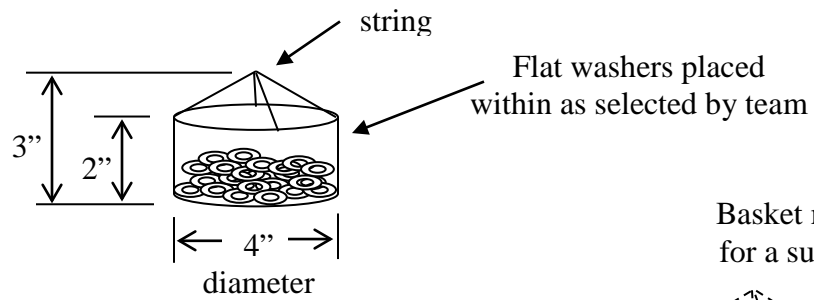
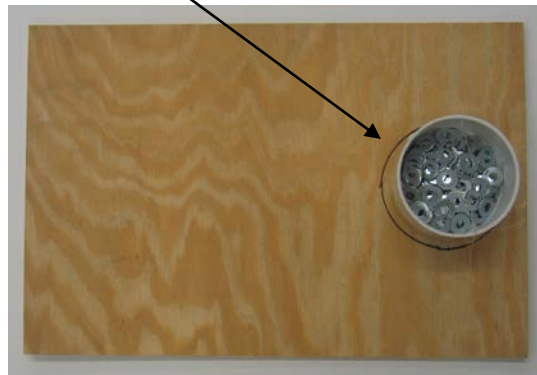
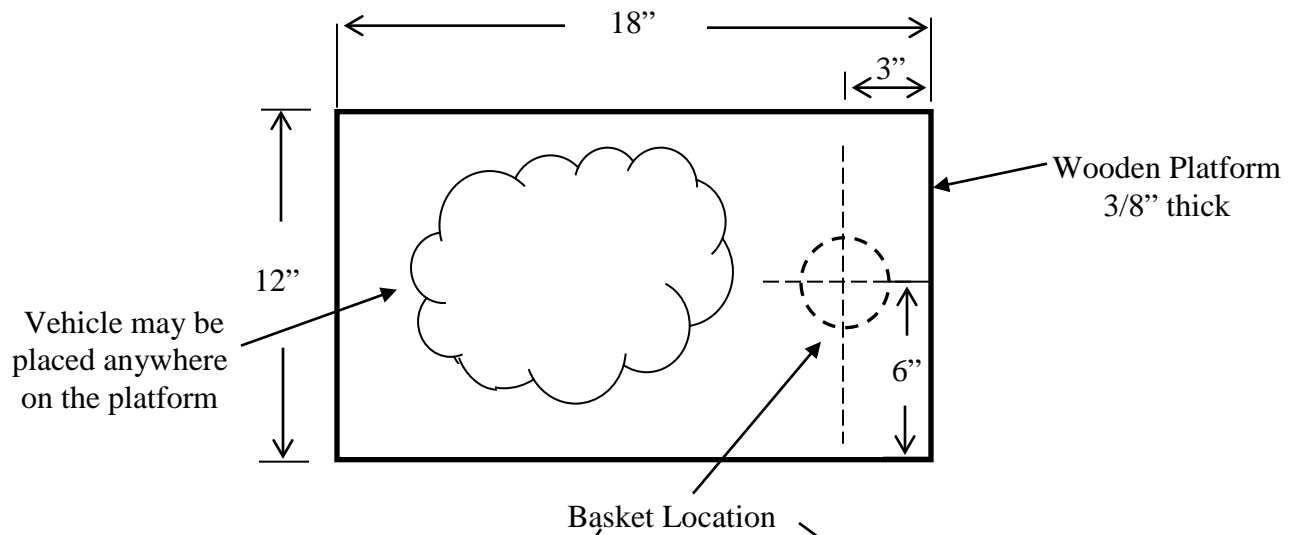
Choosing pre-established weight combinations will insure an efficient use of time and standardization for the judges. Each flat washer weighs approximately 0.25 ounces. This information is provided so that participants may practice with any combination prior to the event. The weight of the basket (approximately 4.2 ounces), is included in the total weight that will be recorded for each team.

TOURNAMENT GUIDELINES:

1. Only parts contained within one LEGO Simple and Motorized Mechanisms Base Set may be used for the project, that is, #779686 or #9686. Older kits needing the newer motor can be upgraded by getting the Power Functions M-Motor #8883, the Battery Box #8881, and the Power Functions 20” Extension Wire #8871.

Please contact the General Chair or the Design Contest Chair for questions regarding the admissibility of a kit, if not specified in the list above.

2. Neither the box the kit comes in, nor the instruction manual furnished with the kit, nor any parts from additional kits may be utilized to obtain a solution.
3. No part may be cut, sanded, whittled, polished or physically altered in any way.
4. No oils, adhesives, tape, glues or chemical additives of any type may be introduced as part of the problem solution.
5. The device must rest on the platform surface, provided by the E3 committee, Figure 1, during the entire competition and must support itself without falling over while connected to the basket. It cannot be clamped in any way, either to the platform or to the baseboard.
6. The battery pack must be attached to the device and cannot be held by the team members.



Basket must be lifted 4" for a successful attempt

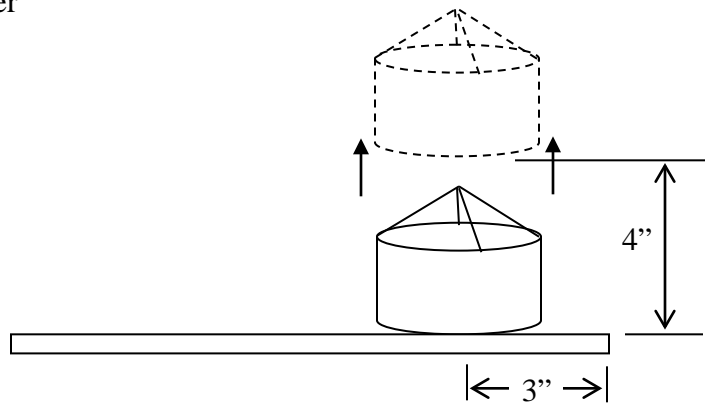


Fig. 1 Basket and Platform

7. The basket, which will be provided by the Committee, is a PVC cup 4 inches in diameter with strings converging to a singular point for attachment to the device (figure 1b). The basket will be rested on the platform with its center 3 inches from the nearest edge as shown in figure 1. *Note, the basket rests on the same platform as the machine.*
8. Flat washers, 3/8 inch in diameter, will be used for the ballast weight within the basket. Each flat washer weighs approximately 0.25 ounces. The tare weight of the basket, approximately 4.2 ounces, will be included in the total weight that will be recorded as the team's score. (Choosing pre-established weight combinations will insure an efficient use of time and standardization. This information is provided so that, participants may practice with any combination prior to the event.)
9. After the washers are added to the basket, the team will have 30 seconds from the time the basket leaves the baseboard to complete the lift.
10. Once the lift has been initiated, the lift must continue without human intervention until either the lift is completed or the time expires. (Note: Machine cannot be held down by the contestants). No modifications will be allowed to the device during the entire run. The lift will be considered completed when any one of the following occurs
 - the basket is raised to a height of 4 inches
 - total lift time is 30 seconds
 - someone / something intervenes with the progression of the lift.
11. All design decisions, journal entries, and assembly of the Lego parts shall be performed by the students on the team. They may consult any resource at their disposal for guidance or clarification, such as teachers and mentors, while working through the problem solving process.
12. There is no limit to the number of eligible student groups that may participate in Option Two of the E³ Fair from any one school. However, the number in each group, is limited to a maximum of four. Team members need not be of the same grade level.
13. Decisions made by the Guidelines Committee Chairpersons or by designated representatives are final.

Note: For questions / clarifications of the rules, please contact the Chair of the Design Contest Committee

OPTION THREE - ROBOTICS

GENERAL DESCRIPTION

Option Three involves a robotic design, computer controlled, hands on problem solving activity. Participants will solve the problem, build their solution, bring their solution of the problem to the Fair and participate in a competition

PROBLEM STATEMENT

Design, construct and program a robot, using parts from a LEGO kit (model number specified by the E3 Committee), capable of removing Coke cans out of a circular playing field in as short a time as possible. The Challenge platform has a boundary circle of radius 18 inches with 7 coke cans, 6 arranged in a circle of radius 9 inches concentric with the boundary circle and one in the center, Figure 2. The robot will be placed in a 'Start Box' outside of, and facing the center of the boundary circle. The robot should be able to get across and into the boundary circle. The robot should fit in the Start Box and its size, shape and orientation should not change after it has been initiated. During the entire competition its size should be such that it fits in the Start Box. It can then push or roll cans out of the circle for a period of 2 minutes, at which time it should turn itself off. The team score is the number of cans outside the circle and the time over which this is accomplished. The winner is the team that removes the largest number of cans in the shortest time.

TOURNAMENT GUIDELINES

1. Only parts contained within any **ONE** of the following LEGO Mindstorms kits maybe used. The software comes with a site license.
 - Mindstorms NXT kit # 979797 with software version 2.1
 - Mindstorms NXT kit # 5003402 with software version 2.1
 - Mindstorms NXT kit # 991308 with software version 2.1
 - Mindstorms NXT software #2000080 or #900080 (equivalent to version 2.1)
 - Mindstorms EV3 core kit #5003400, using software #2000045
 - Mindstorms EV3 core kit with software #5003462
or free software download from www.legoeducation.com/downloads

Participants may choose to use Robolab Team Challenge set #979794 instead, accepting the fact that the motor in the NXT and EV3 kits are more powerful and robust.

Lego Education no longer carries NXT products. You may still use the specified NXT kits/software for this year's E3 Fair.

Please contact the Design Contest Chair for questions regarding the admissibility of a kit, if not specified in the list above.

2. No part may be cut, sanded, whittled, polished or physically altered in any way.
3. No oils, adhesives, tape, glues or chemical additives of any type may be introduced as part of the problem solution.

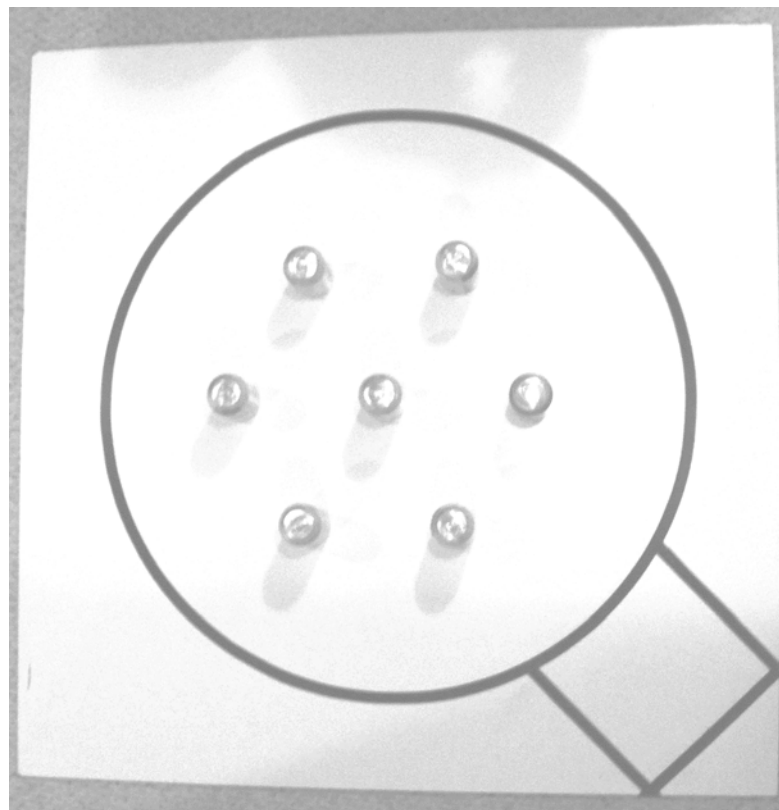
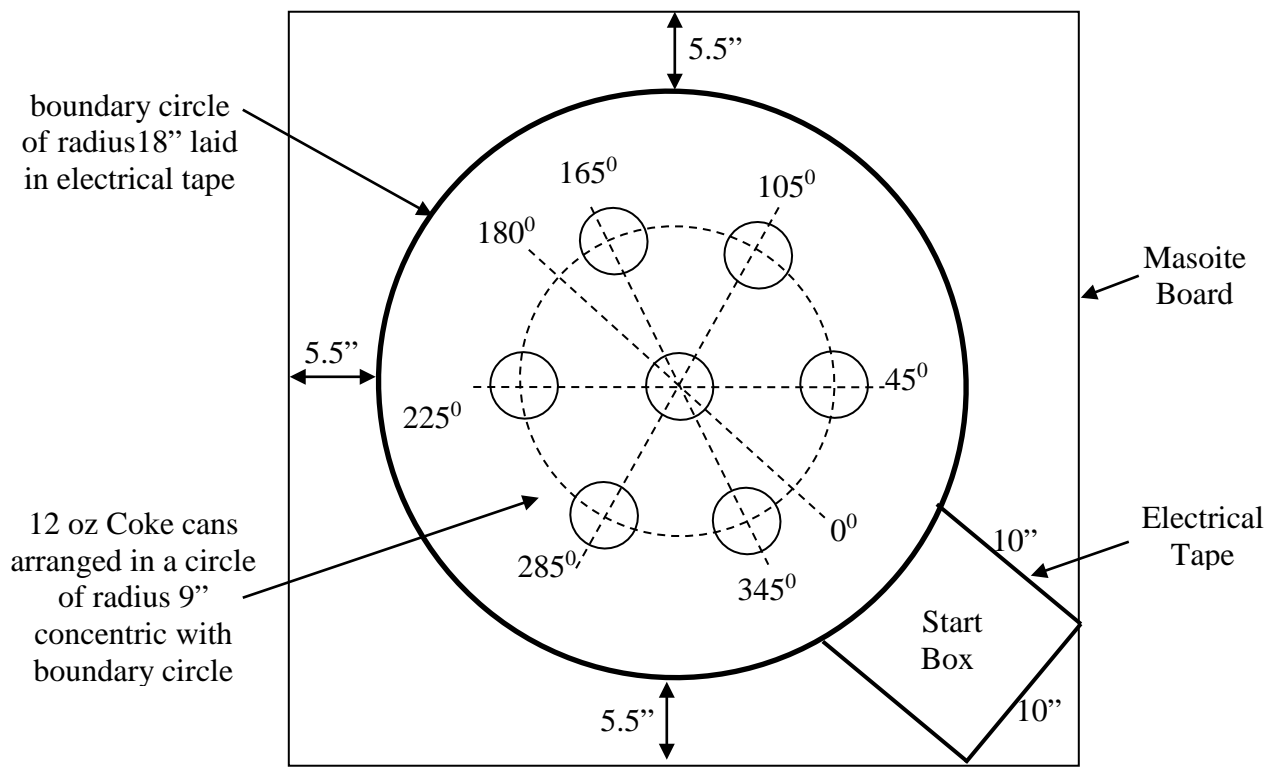


Figure 2. Robot Challenge Playing Field

4. The diagram of the 'Challenge Field' is shown in Figure2. It is laid out on a white, masonite board, 1/8 inch thick, 4 ft by 4 ft in dimension. The boundary circle and the Start Box are laid out with good quality PVC black electrical tape of width 3/4 inches. It is best not to stretch the tape as it is being applied. Also, smooth out any wrinkles so they do not interfere with the robot's movement.
5. The robot will start from inside the 'Start Box' facing the center of the circle and outside the boundary circle. It should fit in this box. Once it has been initiated, it should not change its shape, size or orientation during the entire competition. During the entire competition its size should be such that it fits in the Start Box.
6. The Coke cans, (12 oz) are arranged as shown above, six of them placed in a circle of radius 9" with one in the center. The cans are emptied, half filled with kitty litter and resealed by duct tape. The total weight of the can with the kitty litter is 160gms.
7. The robot should be able to get across and into the boundary circle. The robot can then push or roll cans out of the boundary circle.
8. Once the robot has been initiated, it must continue, without human intervention, until the run is complete.
9. A can is counted 'out' the moment it is completely over the boundary circle.
10. The robot may use the area outside the boundary circle for turning only. It is not advisable for the robot to leave the masonite board since the edges of the board may be curled in which case it should be capable of climbing back on the playing field again. If it stays outside the boundary circle for more than 20 sec, the round will be considered over.
11. The time for the round is 2 minutes at which time the robot should turn itself off.
12. The team score is the number of cans outside the circle and the time period over which this is accomplished. The winner is the team that removes the largest number of cans in the shortest time. Each team will be allowed two rounds. The best of the two scores will be considered.
13. All design decisions, journal entries, and assembly of the robot must be performed by the students on the team. They may consult any resource for guidance or clarification, such as teachers and mentors, while working through the problem solving process.
14. There is no limit to the number of student groups that may participate in Option Three from any one school. However, the number in each group, is limited to a maximum of four. The team members need not be of the same grade level.
15. Decisions made by the Guidelines Committee or by designated representatives are final.

Note: For questions / clarifications of the rules, please contact the Chair of the Design Contest Committee.

PRIZES

Results will be announced at the end of the Fair. Trophies will be awarded to top performers.

Additional Activities at the E3 Fair

Students are required to complete the following two activities to receive an E3Fair gift.

1. There will be a number of informational booths sponsored by various technical societies, local industries and area colleges and universities. These booths are intended to illustrate various aspects of engineering, science, and technology and inform both participants and visitors to the Fair of career opportunities in a wide variety of technical fields.

Each student will be given a card with a complete listing of the booths. When the student participates in the activities at a booth, the card will be stamped by the booth presenter. A specified number of stamps are acquired on the card.

2. There are typically over fifty Option #1 Science and Engineering projects on display. Students are required to visit these projects and write down the titles of their 3 most favorite ones.

Upon completion of the above two activities the student will receive an E3Fair gift at the Rochester Engineering Society booth.

E³ FAIR - OPTION ONE
PROJECT REGISTRATION FORM

www.e3fair.org

One copy of this registration form must be completed for each Option One project being entered in the E³ Fair and submitted no later than **February 22, 2019**.

Please mail or email completed forms to: Dr. Adelaide Svoboda
70 Brandywine Lane,
Rochester, NY 14618
ajsvobod@gmail.com

Grade: _____

Name(s) of student(s)

1. _____
2. _____
3. _____
4. _____

School and address: _____

Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____

Title of Project: _____
(60 characters max)

Anticipated special requirements: _____
(120-volt electrical power, compressed air, etc.)

E³ FAIR - OPTION TWO
PROJECT REGISTRATION FORM

www.e3fair.org

One copy of this registration form must be completed for each Option One project being entered in the E³ Fair and submitted no later than **February 22, 2019**.

Please mail or email completed forms to: Dr. Adelaide Svoboda
70 Brandywine Lane,
Rochester, NY 14618
ajsvobod@gmail.com

<u>Name</u>	<u>Grade:</u>
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

School and address: _____

Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____

E³ FAIR - OPTION THREE
PROJECT REGISTRATION FORM

www.e3fair.org

One copy of this registration form must be completed for each Option One project being entered in the E³ Fair and submitted no later than **February 22, 2019**.

Please mail or email completed forms to: Dr. Adelaide Svoboda
70 Brandywine Lane,
Rochester, NY 14618
ajsvobod@gmail.com

	<u>Name</u>	<u>Grade:</u>
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

School and address: _____

Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____