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## Science, Technology, Engineering & Math

Superintendent: Lynelle Johnson

### STEM Rockets

This category gives 4-H'ers a chance to display the rockets and drones they have created. Through participation in this category 4-H'ers will show judges what they learned about and how they adapted their exhibit throughout this project. Involvement in STEM Rockets gives participants a first-hand experience in modern technology. For help getting started with this project contact your county 4-H office.



#### Rules

1. The name and county of each exhibitor should appear separately on the back of each board, poster or article and on the front cover of the notebooks so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
2. Rockets must be supported substantially in order to protect the rocket from breakage. Rockets are to be mounted on a base that has dimensions equal to or less than 12 inches x 12 inches and the base should be 3/4 inch thick. No metal bases. If the rocket fins extend beyond the edges of the required base (12 inches x 12 inches), then construct a base that is large enough to protect the fins. The base size is dictated by the size of the rocket fins.
3. The rockets must be mounted vertically. Please do not attach sideboards or backdrops to the displays. In addition, a used engine or length of dowel pin is to be glued and/or screwed into the board and extended up into the rocket's engine mount to give added stability.
4. Rockets must be equipped as prepared for launching, with wadding and parachute or other recovery system. Rockets entered with live engines, wrong base size or sideboards will be disqualified.
5. A report, protected in a clear plastic cover, must include: 1) rocket specification (include original or photo of manufacture packaging stating rocket skill level), 2) a flight record for each launching (weather, distance, flight height), 3) number of launchings, 4) flight pictures 5) Safety (how did you choose your launch site? Document safe launch, preparations, and precautions) 6 objectives learned and 7) conclusions.
6. The flight record should describe the engine used, what the rocket did in flight and recovery success. Points will not be deducted for launching, flight or recovery failures described. This includes any damage that may be shown on the rocket. Complete factory assembled rockets will not be accepted at the State Fair.
7. Judging is based upon display appearance, rocket appearance, workmanship, design or capabilities for flight, number of times launched and report. Three launches are required to earn the maximum launch points given on the score sheets. For scoring for the State Fair, only actual launches count, misfires will not count towards one of the required three launches.
  - For self-designed rockets only, please include a digital recorded copy of one flight. In the documentation, please include a description of stability testing before the rocket was flown.
  - The skill level of a project is not determined by the number of years in the project. Skill level is determined by the level listed on the manufacturing packaging.
  - 4-H Rocket project levels are not intended to correspond to National Association of Rocketry model rocket difficulty ratings or levels.
8. **High power rockets (HPR) are similar to model rocketry with differences that include the propulsion power and weight increase of the model. They use motors in ranges over "G" power and/or weigh more than laws and regulations allow for unrestricted model rockets. These rockets are NOT appropriate for 4-H projects and will be disqualified.**
9. Posters can be any size up to 28 inches by 22 inches when ready for display. Example: tri fold poster boards are not 28 inches by 22 inches when fully open for display.  
Eligibility: All static exhibits must have received a purple ribbon at the county fair to advance to the State Fair. Entry level rockets, made with PLASTIC FINS and PLASTIC BODY TUBES, are COUNTY ONLY projects.

PREMIUM	Purple	Blue	Red	White
	\$5.00	\$4.00	\$3.50	\$3.00

#### Rockets

**H850-901 Single Stage Rocket** up to 15" in length.

**H850-902 Display** Display exemplifying one of the principles learned in Flight Crew. Examples include: diagram of rocket or jet, interview with firefighter, pilot or air traffic controller, design for an airport, model space station.

**H850-903 Trebuchet** mini-catapult

**H850-904 Rocket** Any water rocket made with a 2-liter plastic bottle.

**H850-905 Display** Display exemplifying one of the principles learned in the Water Rocket Project. Examples include: Display of rocket parts and purpose, interview of someone in the aerospace field, picture board and description of

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building and/or launching a water rocket, story of building and/or launching a water rocket. Display can be any size and any material can be used.

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	\$6.00	\$5.00	\$4.50	\$4.00

**H850-001 Rocket** (SF92) Any Skill Level rocket with wooden fins and cardboard body tubes painted by hand or air brush.

**H850-002 Aerospace Display** (SF93) Poster or display board that displays or exemplifies one of the principles learned in the Lift Off project. Examples include: display of rocket parts and purpose, explaining the parts of a NASA rocket or shuttle, interview of someone in the aerospace field, or kite terminology. Include a notebook containing terminology (definition), and what was learned. Display can be any size up to 28 inches by 22 inches.

**H850-003 Rocket** (SF92) Any Skill Level 2 Rocket with wooden fins and cardboard tubes painted using commercial application. Example – commercial spray paint.

### **Self Designed Rocket**

**H850-004 Rocket** (SF92) Any self-designed rocket with wooden fins and cardboard tubes.

### **Drones**

**H850-005 Drone Poster** (SF93) Exhibit must be designed to educate yourself and others on one or more of the following topics: drone technologies, uses of drones, the different types of drones, types of training needed to operate drones, and the laws and regulations users must follow. Posters can be any size up to 28 inches by 22 inches.

**H850-006 Drone Video** (SF93) Exhibit must demonstrate how the drone interacts with the outside world. Examples include: field scouting, surveying damage from natural disasters, drones used in commercial applications and settings, drones used for structural engineering. Video should not exceed 5 minutes. Exhibitors should be encouraged to test their codes or links on several devices to check for appropriate permissions for public viewing. .

## **STEM Computers**

This category gives 4-H'ers a chance to display their knowledge of computers. Through participation in this category 4-H'ers will develop presentations that show judges their knowledge in the different aspects of computer science. Involvement in STEM Computers gives participants a first-hand experience in modern technology.



### **Rules**

1. The name and county of each exhibitor should appear separately on the back of each board, poster or article and on the front cover of the notebooks so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
2. Demonstration boards should include an overall title for the display, plus other necessary labeling.
3. Reports should be written using the scientific method whenever possible (Background, the Question or hypothesis, what you plan to do and what you did, Method used and observations, Results: what you learned.) All reports should be computer generated and enclosed in a clear plastic cover. The reports should be attached securely to the display.
4. Reports should be written using the scientific method whenever possible (Background, the Question or hypothesis, what you plan to do and what you did, Method used and observations. Results: What you learned. All reports should be computer generated and enclosed in a clear, plastic cover. The reports should be attached securely to the display.
5. Please refer to the General Rules for the policy regarding firearms, items with a blade, and other related items.
6. Please refer to the General Rules for the policy regarding use of copyrighted images.
7. Premier 4-H Science Award is available in this area.
8. Team Entries: To qualify for entry at the Nebraska State Fair team materials entered in H860008 Maker Space/Digital Fabrication must clearly be the work of a team instead of an individual and must have at least 50% of all team members enrolled in 4-H. Additionally, all enrolled 4-H members on the team should complete and attach an entry tag to the materials. A supplemental page documenting the individual contributions to the project should be included. The entry will be judged as a team, with all team members receiving the same ribbon placing.

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	\$5.00	\$4.00	\$3.50	\$3.00

### **Computer Mysteries: Unit 2**

**H860-001 Computer Application Notebook** (SF277) Using presentation software a 4-H exhibitor designs a multimedia computer presentation on one topic related to youth. 4-H'er may create any of the following: greeting card (5 different cards such as a birthday, wedding, anniversary, sympathy get well or other); a business card (3 cards for 3 different individuals and businesses); menu (minimum of 2 pages including short description of foods and pricing); book layout (I-book); promotional flyer (3 flyers promoting 3 different events); newsletter (minimum 2 pages); or other: examples such as precision farming or family business logo etc. This exhibit consists of a notebook (8.5x11 inches)

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which should include a (1) a detailed report describing: (a) the task to be completed, (b) the computer application software required to complete the task, (c) specific features of the computer application software necessary for completing the task (2) print out of your project. Project may be in color or black and white.

**H860-002 Produce a Computer Presentation (SF276)** Using presentation software a 4-H Exhibitor designs a multimedia computer presentation on one topic related to youth. A notebook with a printout of all the slides should be submitted. Slideshow should include a minimum of 10 slides and not more than 25. Incorporate appropriate slide layouts, graphics, animations, and audio (music or voice and transition sounds do not count). Each slide should include notes for a presentation. All slideshows must be uploaded.

PREMIUM	Purple	Blue	Red	White
	\$8.00	\$7.00	\$6.00	\$5.00

### **Computer Mysteries: Unit 3**

**H860-003 Produce an Audio/Video Computer Presentation (SF276)** Using presentation software a 4-H exhibitor designs a multimedia computer presentation on one topic related to youth, including audio and/or video elements. A notebook with a printout of all the slides should be submitted. The presentation should be at least 2 minutes in length and no more than 5 minutes in length, appropriate graphics, sound and either a video clip, animation, or voice over and/or original video clip.

**H860-004 How to STEM (Science, Technology, Engineering and Math) Presentation (SF276)** Youth design a fully automated 2 to 5 minute 4-H "how to" video. Submissions should incorporate a picture or video of the 4-H'er, as well as their name (first name only), age (as of January 1 of the current year), years in 4-H, and their personal interests or hobbies. Videos should be designed for web viewing. Any of the following formats will be accepted: .mpeg, .rm, .wmv, .mp4, .ov, .ppt, or .avi.

**H860-005 Virtual Platform Presentation (SF276)** Youth design a fully automated educational presentation using any multimedia platform such as Tik Tok, YouTube, Canva, Canvas, etc. Submissions may include a notebook, poster, etc., explaining the process, /experience, and/or /presentation. All submissions must include a link to the virtual presentation.

**H860-006 Create a Web Site/Blog or App (SF275)** Design a simple web site, blog, or app for providing information about a topic related to youth. Include an explanation of why the entry was created. (Any current website, /blog, or app development platform is accepted such as. Ex. Google Sites, iBuildApp, Wix, etc.). If the website, blog, or app isn't live, include all files on a flash drive in a plastic case.

**H860-007 3D PRINTING (SF1050)** 3D printing uses plastic or other materials to build a three-dimensional (3D) object from a digital design (including 3D Pen Creation). Youth may use original designs or someone else's they have redesigned in a unique way. Exhibits will be judged based on the motivation and/or problem identified. For example, 3D objects printed as part of the design process for robot or other engineering project. Must include design notebook that addresses the following questions:

1. What was the motivation for your design or the problem you were solving with your design? i.e.. is your item a functional or decorative piece?
2. Please include a picture of original design, citation of designer/website OR if design is completely original (you created it using CAD software), then state that it's original. If item was not completely original, indicate what you did to the original design to modify it to better meet the design problem stated in #1 above. Its design was modified multiple times, please indicate what change was made with each modification, and what prompted the need for the change. i.e. "I printed it and the design was too fragile, so I resliced the print to make thicker external walls, or to have a denser infill".
3. Define your process for designing/printing. What software and/or hardware was used (indicate type of 3D printer or if item was created with 3D pen)?
4. What materials were selected for your project?
5. If your final design has any moving parts, define how you determined appropriate allowance in your design.
6. Identify any changes that you would make to improve your design.

**H860-008 Maker Space/ Digital Fabrication (SF1050)** This project is a computer generated project created using a laser cutter, vinyl cutter, heat press or CNC router. Vector or 3D based software such as coreldraw or Fusion 360 would be an example of appropriate software used to create your finished project. Project should include a notebook with the following:

- a. What motivated you to create this project
- b. Software and equipment used
- c. Directions on how to create project
- d. Prototype of plans
- e. Cost of creating the project.
- f. Iterations or modifications made to original plans
- g. Changes you would make if you remade the project

**Team Entry Option:** To qualify for entry at the Nebraska State Fair team materials entered in H860-007 – Maker Space/Digital Fabrication must clearly be the work of a team instead of an individual and must have at least 50% of all team members enrolled in 4-H. Additionally, all enrolled 4-H members on the team should complete and attach an

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entry tag to the materials. A supplemental page documenting the individual contributions to the project should be included. The entry will be judged as a team, with all team members receiving the same ribbon placing.

## STEM Electricity

In this category 4-H'ers have the opportunity to create informational exhibits about the different aspects of electricity. Through involvement in this category 4-H'ers will be better educated about electricity and be able to present their knowledge to others.



### Rules

1. The name of each exhibitor should appear separately on the back of each board, poster or article and on the front cover of the notebooks so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
2. Several classes require a display board which should be a height of 24 inches and not to exceed 1/4-inch thickness. A height of 24 7/8 inches is acceptable to allow for the saw kerf (width) if two 24 inch boards are cut from one end of a 4 foot by 8-foot sheet of plywood. Nothing should be mounted within 3/4 inch of the top or bottom of the board. (Example: Woodworking & Electricity.)
  - o Fabricated board such as plywood, composition board, or particle-type lumber may be used for demonstration displays.
  - o Demonstration boards should be sanded and finished to improve their appearance. The finish on a demonstration board will be judged as a woodworking exhibit.
  - o Demonstration boards should include an overall title for the display, plus other necessary labeling.
  - o Reports should be written using the scientific method whenever possible (Background, the Question or hypothesis, what you plan to do and what you did, Method used and observations, Results: what you learned. All reports should be computer generated and enclosed in a clear plastic cover. The reports should be attached securely to the display. Eligibility: Exhibits must have received a purple ribbon at the county fair to advance to State Fair.

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	\$5.00	\$4.00	\$3.50	\$3.00

### Magic of Electricity: Unit 1

**H870-901 Unit 1 Control the Flow** Make a switch. Use the following items: D cell battery, battery holder, insulated wire, 1 or 2 - flashlight bulb(s), bulb holder, paper clip, cardboard, and two brass paper fasteners to create a circuit that you can open and close. Label your circuit board parts and explain the complete circuit process.

**H870-902 Unit 1 Conducting Things** Make a circuit with a switch and a light bulb that can be used to test different household items for their ability to act as an insulator or conductor. You must find five items that are insulators or conductors. Create a table that illustrates your results.

**H870-903 Demonstration Board** This exhibit is to be prepared on a board that is 1/4 inch thick x 24 inches high x 32 inches wide. Include two graphics and four items made or studied in the Unit I Magic of Electricity project. The graphic may show what electricity is, how a battery works, 10 electricity safety rules, the results of the home lighting survey, etc. The four items may include a simple fuse, simple switch, circuit board, cut away flashlight, electra-plated object, conductors-nonconductors, etc. Be sure to include the appropriate labeling.

**H870-904 Quiz Board or Steady Hand Tester** Game will be judged on usefulness, craftsmanship and wiring skill. Include battery or power supply to operate the exhibit. Questions on the quiz board could deal with any topic.

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	\$6.00	\$5.00	\$4.50	\$4.00

### Investigating Electricity: Unit 2

**H870-905 Rocket Launcher** Construct a rocket launcher out of the following materials: a plastic pencil box that is at least 4 inches by 8 inches, single pole switch, single throw switch, normally-open push button switch, 40 feet of 18 or 22 gauge stranded wire, 4 alligator clips, 2 inches by 6 inches board 6 inches long, 1/8 inch diameter metal rod, rosin core solder, soldering iron or gun, wire stripper, small crescent wrench, pliers, small Phillips and straight blade screwdrivers, drill, 1/8 inch and 1/4 inch drill bits, rocket engine igniters, additional drill bits matched to holes for two switches. You must successfully build a rocket launcher and light two rocket igniters with your launcher. You DO NOT have to actually fire a rocket off of the launcher. Create a poster using photographs to show the "step by step process" you used to build your launcher.

**H870-906 Stop the Crime** Build an ALARM using the following materials: On-off push button switch, mercury switch, buzzer-vibrating or piezoelectric, 9-volt battery, 9-volt battery holder, 4 inches by 4 inches by 1/8 inch Plexiglas board to mount circuit on; rosin core solder, soldering gun/iron, two feet of 22-gauge wire, wire strippers, hot glue sticks, hot glue gun and a plastic box with a lid to mount your alarm circuit on. Create a poster using photographs to show the "step by step process" you used to build your alarm.

**H870-907 Modified Toy Motors** Electric motors entered with changes made by the 4-H'ers to improve design and operation. Any motors entered with design changes must also include a story telling what changes were made and the results. Enclose the story in a clear plastic cover. NO pre-manufactured kit electric motors will be accepted.

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**H870-908 Electric Motor Converted to DC or AC Generator** Exhibit is to consist of the toy electric motor shown in Unit II, converted to use as a DC or AC generator. Generator should be exhibited on a base including a battery and a light bulb or Galvanoscope to demonstrate its operation. Title the exhibit and label the major parts.

**H870-909 Switching Circuits:** Build a three-way switch. Use the following items: D cell battery, battery holder, insulated wire, 2 -7.5-volt light bulb, bulb holder, 2 paper clips, cardboard and 4 brass paper fasteners to build a three-way switch circuit. Label your circuit board parts and explain the process.

	PREMIUM	Purple	Blue	Red	White
CLASSES 4 & 8		\$4.00	\$3.00	\$2.50	\$2.00
CLASSES 1-3 & 5-7 & 10		\$8.00	\$7.00	\$6.00	\$5.00

### **Wired for Power: Unit 3**

**H870-001 Electrical Tool/Supply Kit** (SF224) Create an electrical supply kit to be used for basic electrical repair around the house. Include a brief description of each item and its use. Container should be appropriate to hold items. (SF224)

**H870-002 Lighting Comparison** (SF225) Display studying the efficiency of various lighting (incandescent, fluorescent, halogen, Light Emitting Diodes, etc.) Exhibit could be a poster display, or an actual item.

**H870-003 Electrical Display/Item** (SF226) Show an application of one of the concepts learned in the Wired for Power project. Examples include: re-wiring or building a lamp, re-wiring or making a heavy duty extension cord or developing an electrical diagram of a house. Exhibit could be a poster display, or an actual item. (Do not bring a lamp shade)

**H870-004 Poster** (SF227) Should exemplify one of the lessons learned in the Wired for Power Project. Posters can be any size up to 28 inches by 22 inches.

### **Electronics: Unit 4**

**H870-005 Electrical/Electronic Part Identification** (SF228) Display different parts used for electrical/electronic work. Exhibit should show the part (either picture or actual item) and give a brief description, including the symbol of each part and its function. Display should include a minimum of 10 different parts.

**H870-006 Electronic Display** (SF229) Show an application of one of the concepts learned in the Electronics project. Examples include: components of an electronic device.

**H870-007 Electronic Project** (SF230) Exhibit an electronic item designed by the 4-H'er or from a manufactured kit that shows the electronic expertise of the 4-H'er. Examples include: a radio, a computer, or a voltmeter.

**H870-008 Poster** (SF231) Should exemplify one of the lessons learned in the Entering Electronics Project. Posters can be any size up to 28 inches by 22 inches.

## **STEM Energy**

This category provides 4-H'ers a way to present their ideas about energy. Through participation in this category 4-H'ers will learn more about physics, friction, energy, and elasticity. In addition, participants will make a display to go along with their findings.

### **Rules**

1. The name and county of each exhibitor should appear separately on the back of each board, poster or article and on the front cover of the notebooks so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
2. Reports should be written using the scientific method whenever possible (Background, the Question or hypothesis, what you plan to do and what you did, Method used and observations, Results: what you learned. All reports should be computer generated and enclosed in a clear plastic cover. The reports should be attached securely to the display.
3. Posters can be any size up to 28 inches by 22 inches when ready for display. Example: tri fold poster boards are not 28 inches by 22 inches when fully open for display.
4. All static exhibits must have received a purple ribbon at the county fair to advance to the State Fair.

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	\$4.00	\$3.00	\$2.50	\$2.00

### **Energy**

**H900-001 Create and Compare Energy Resources Poster** (SF307) Poster should explore 2 alternative/renewable energy resources. Compare and contrast the 2 resources including two of the following information: amount of energy created, costs of production, usability of the energy, pros/cons of environmental impacts, etc. Posters can be any size up to 28 inches by 22 inches.

**H900-002 Experiment Notebook** (SF305) Notebook will explore the scientific method involving alternative/renewable energy sources. Information required. 1.) Hypothesis 2.) Research 3.) Experiment 4.) Measure 5.) Report or Redefine Hypothesis.



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**H900-003 Solar as Energy Display/ Poster (SF308)** Item should be the original design of the 4-H'er. Include the item, or a picture if the item is in excess of 6 feet tall or 2 feet X 2 feet. Include a notebook of why the item was designed and how it harnesses the power of solar. Examples include solar ovens, solar panels, etc.

**H900-004 Water as Energy Display/ Poster (SF308)** Item should be the original design of the 4-H'er. Include the item, or a picture if the item is in excess of 6 feet tall or 2 feet X 2 feet. Include a notebook of why the item was designed and how it harnesses the power of water.

**H900-005 Wind as Energy Display/ Poster (SF308)** Item should be the original design of the 4-H'er. Include the item, or a picture if the item is in excess of 6 feet tall or 2 feet X 2 feet. Include a notebook of why the item was designed and how it harnesses the power of wind.

**H900-006 Other Nebraska Alternative Energy (SF306)** Notebook should explore Nebraska as an alternative energy source besides wind, water, and solar power. Include information on type of power chosen, infrastructure for distribution, what resources are needed to create this alternative resource, cost of production, and potential uses of bio-products. Examples include geothermal, biomass, ethanol, bio-diesel, methan reactors, etc.



## STEM Geospatial

STEM Geospatial is a diverse category that includes a variety of exhibits 4-H'ers can get involved in. Through participation in this category 4-H'ers will gain more knowledge about Nebraska's rich history and diverse geography. Take close note of the rules to ensure your exhibit qualifies.

### Rules

1. The name of each exhibitor should appear separately on the back of each board, poster or article and on the front cover of the notebooks so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
2. Reports should be written using the scientific method whenever possible (Background, the Question or hypothesis, what you plan to do and what you did, Method used and observations, Results: what you learned. All reports should be computer generated and enclosed in a clear plastic cover. The reports should be attached securely to the display.
3. Please refer to the General Rules for the policy regarding firearms, items with a blade, and other related items.
4. Please refer to the General Rules for the policy regarding use of copyrighted images.
5. Premier 4-H Science Award is available in this area.
6. All static exhibits must have received a purple ribbon at the county fair to advance to the State Fair.

	PREMIUM	Purple	Blue	Red	White
Classes 1 & 2		\$4.00	\$3.00	\$2.50	\$2.00
Classes 3-10		\$5.00	\$4.00	\$3.50	\$3.00

## Geospatial

**H880-001 Poster (SF299)** Create a poster (not to exceed 14 inches X 22 inches) communicating a GPS theme such as "How GPS or GIS Works", "Careers that use GPS or GIS", "How to use GPS", "What is GIS, GPS", "GIS in Agriculture", "Precision Agriculture" or a geospatial topic of interest.

**H880-002 4-H Favorite Places or Historical Site Poster (SF299)** The 4-H exhibitor identifies a favorite place or historical site (including grave sites) in Nebraska. Exhibit should include latitude and longitude, digital picture, and local area map. Poster size should not exceed 14 inches X 22 inches.

**H880-003 GPS Notebook (SF300)** Keep a log of at least 5 places visited using a GPS enabled device. At least one site should be from a community other than where you live. For each site, record the latitude, longitude and elevation. Also include a description of the site, a paragraph explaining what was interesting about the site or finding it. Photos of each site and/or cache are optional but encouraged.

**H880-004 Geocache (SF301)** Assemble a themed geocache. A physical geocache is **REQUIRED** with exhibit. Each geocache should be a water-tight container. It should include a logbook and pencil for finders to log their visits and may include small trinkets, geocoins, etc. for the finders to trade. Documentation should include a title, teaser description and the geographic coordinates of intended placement. Register the site at [geocaching.com](http://geocaching.com) and include a print-out of its registry. The entry may include a photograph of the cache in its intended hiding place.

**H880-005 Agriculture Precision Mapping (SF302)** 4-H'ers will assemble a notebook that will include a minimum of 2 digital copies of various data layers that can be used in precision agriculture to identify spatial patterns and/or correlations (printed copies of websites were applications can be purchased is acceptable) A report of how the analysis of the various data will be used to make a management decision.

**H880006 4-H History Map/Preserve 4-H History (SF 303)** Nominate a Point of Interest for the 4-H History Map Project Project. Include a copy of the submitted form in the folder or notebook. To nominate a site for the 4-H history map please go to <http://arcg.is/1bvGogV>. For more information about 4-H history go to: [http://www.4-historypreservation.com/History\\_Map](http://www.4-historypreservation.com/History_Map). For a step by step video on nominating a point, please go to this link: <http://tinyurl.com/nominate4h>. Write a brief description of the historical significance of a 4-H place or person. (a minimum of one paragraph)

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**H880-007 GIS Thematic Map (SF302)** Using any GIS software, create a thematic. Thematic maps can utilize any subject of interest to the 4-H'er. Example maps would be Amelia Earhart's or Sir Francis Drake's voyage population density maps, water usage maps or 4-H project in Nebraska. Create a GIS Map using data from books, or the internet. Use reliable data, (U.S. Center or U.S. Census Bureau etc.) Map any size from 8.5 inches x 11 inches up to 36 inches x 24 inches, which should include Title, Base Map, Neat Line, North Arrow, and Legend. Identify the source of your information on the back of the map.

**H880-008 Virtual Geocache (SF300)** Keep a log of at least 5 places visited using a virtual geocache platform. At least one site should be from a community other than where you live. For each site, record the latitude, longitude and elevation. Also include a description of the site, a paragraph explaining what was interesting about the site or finding it. Photos of each site and/or cache are optional, but highly encouraged.

## STEM Robotics

This category involves the many different aspects of Robotics. Participants will learn more about how robots are designed and developed as well as the mechanical and electronic elements of robots. Involvements in STEM Robotics gives participants first-hand experience in modern technology.



### Rules

1. The name of each exhibitor should appear separately on the back of each board, poster or article and on the front cover of the notebooks so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
2. Reports should be written using the scientific method whenever possible (Background, the Question or hypothesis, what you plan to do and what you did, Method used and observations, Results: what you learned. All reports should be computer generated and enclosed in a clear plastic cover. The reports should be attached securely to the display.
3. Posters can be any size up to 28 inches by 22 inches when ready for display. Example: tri fold poster boards are not 28 inches by 22 inches when fully open for display.
4. Eligibility- All static exhibits must have received a purple ribbon at the county fair to advance to the State Fair.
9. Team Entries: To qualify for entry at the Nebraska State Fair team materials entered in robotics classes that are clearly the work of a team instead of an individual must have at least 50% of all team members enrolled in 4-H. Additionally, all enrolled 4-H members on the team should complete and attach an entry tag to the materials. A supplemental page documenting the individual contributions to the project should be included. The entry will be judged as a team, with all team members receiving the same ribbon placing.

PREMIUM	Purple	Blue	Red	White	
Class 1		\$4.00	\$3.00	\$2.50	\$2.00
Classes 2-8 & 901	\$8.00	\$7.00	\$6.00	\$5.00	

### Robotics

**H861-001 Robotics Poster (SF236)** Create a poster (28 inches by 22 inches) communicating a robotics theme such as "Robot or Not", "Pseudocode", "Real World Robots", "Careers in Robots", "Autonomous Robotics", "Precision Agriculture" or a robotic topic of interest to the 4-H'er.

**H861-002 Robotics Notebook (SF237)** Explore a robotics topic in-depth and present your findings in a notebook. Documentation should include any designs, research, notes, pseudocode, data tables or other evidence of the 4-H'ers learning experience. The notebook should contain at least three pages. Topics could include a programming challenge, programming skill, calibration, sensor exploration, or any of the topics suggested in Class 1.

**H861-004 Robotics Careers Interview (SF239)** Interview someone who is working in the field of robotics and researching a career in robotics. Interviews can either be written or in a multimedia format such as a short video uploaded to a cloud sharing service. Include a QR code with your project to allow for judging access. Written interviews should be in a notebook. Written reports should be 3 to 5 pages, double spaced, 12-point font, and 1 inch margins. Multimedia reports should be between 3 to 5 minutes in length.

**H861-005 Robotics - Sensor Notebook (SF241)** Write pseudo code which includes at least three sensor activities. Include the code written and explain the code function. Codes can be submitted as a multimedia format uploaded to a cloud sharing service. Include a QR code with your project to allow judging access. Multimedia presentations should be 3 to 5 minutes in length.

**H861-007 Kit Labeled Robot (cannot be free programmed) and Notebook (SF243)** This class is intended for explorations of robotic components such as arms or vehicles OR educational kits marketed as robots that do not have the ability to be programmed to "sense, plan and act." The exhibit should include a notebook with the robot the youth has constructed. Included in the notebook should be (1) a description of what the robot does, (2) pictures of programs the robot can perform, (3) why they chose to build this particular form, and (4) how they problem solved any issues they might have had during building and programming. A picture story of assembly is recommended. If the robot is more than 15" inches wide and 20" inches tall they may not be displayed in locked cases.

**H861-008 3D Printed Robotics Parts (SF244)** This class is intended for youth to create parts through 3D printing, that help create their robot or aid the robot in completing a coded function. Project should include a notebook describing the process used to create the project, describing the success of your designed piece (did it work), intended use of the product and the modifications made to the item.

Awards will only be given to the top purple ribbon winner in each of the curriculum areas. Entry must earn a purple ribbon to earn awards and rosettes. All static exhibits must have received a purple ribbon at the county fair to advance to the State Fair. Classes that are listed as a "900" number (last 3 digits of the class number) are Hamilton County Fair only exhibits and are not eligible to advance to the Nebraska State Fair, regardless of ribbon placement. County only entries are still eligible for County Awards.

## STEM Welding

This category helps 4-H'ers learn the basics of welding. In addition, 4-H'ers get the opportunity to present their knowledge on the topic and display what they have made. Involvement in STEM Welding gives participants a first-hand experience in a skill that can be used for a lifetime.



### Rules

1. The name and county of each exhibitor should appear separately on the back of each board, poster or article and on the front cover of the notebooks so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
2. All welds exhibited in class 1 or 2 must be mounted on a 12 inches high x 15 inches long display board of thickness not to exceed 3/8 inch. Attach each weld on a wire loop hinge or equivalent, so the judge can look at the bottom side of the weld when necessary. Each weld should be labeled with information stated 1) type of welding process (stick, MIG, TIG, Oxy-Acetylene, etc.) 2) kind of weld, 3) welder setting, 4) electrode/wire/rod size, and 5) electrode/wire/rod ID numbers. Attach a wire to the display board so it can be hung like a picture frame. No picture frame hangers accepted.
3. Fabricated board such as plywood, composition board, or particle-type lumber may be used for demonstration displays.
4. Demonstration boards should be sanded and finished to improve their appearance. The finish on a demonstration board will be judged as a woodworking exhibit.
5. Reports should be written using the scientific method whenever possible (Background, the Question or hypothesis, what you plan to do and what you did, Method used and observations, Results: what you learned. All reports should be computer generated and enclosed in a clear plastic cover. The reports should be attached securely to the display.
6. If no plans are included with welding art, welding article, welding furniture or composite weld project item will be disqualified.
7. All outside projects MUST have an entry tag and supporting information placed in a protective bag to prevent damage from weather events such as rain and be ATTACHED to projects with string, zip ties, etc.
8. Eligibility- All static exhibits must have received a purple ribbon at the county fair to advance to the State Fair.

### Class 1: 4-H Welding Project Tips and Suggestions: Class 1

1. All welds should be made with the same electrode/wire/rod size and number
2. Welds should be made only on one side of metal so penetration can be judged
3. Welds should be cleaned with a chipping hammer and wire brush. Apply a coat of light oil (penetrating oil) to the metal to prevent rusting. Wipe off excess oil.
4. It is suggested that all welds be of the same size and thickness as metal. These pieces, referred to as coupons, should be 1.5 to 2 inches wide and 3.5 to 4 inches long. A good way to get this size is to buy new cold rolled strap iron and cut to length. The extra width is needed to provide enough metal to absorb the heat from the welding process and prevent the coupons from becoming too hot before the bead is completed. Narrower coupons will become very hot, making an average welder setting too cold at the bead start, just about right in the middle, and too hot at the end. The correct way to weld narrow strips is to make short beads and allow time to cool, however this project requires a full length bead.
5. Stick welding: Suggested coupon thickness - ¼ inch if using ¼ inch rod. Suggested rod-AC and DC straight or reverse polarity- first E-7014, second E-6013
6. MIG welding: Suggested coupon thickness - ¼ inch if using .035 wire and ⅛ inch if using .023 wire
7. Oxy-Acetylene: Suggested coupon thickness - ¼ inch. Suggested rod- ⅛ inch mild steel rod 4-H

### Class 2 Welding Project Tips and Suggestions: Class 2

1. It is suggested that all welds be of the same size and thickness of metal. These pieces are referred to as coupons. The welds can be on one coupon that is about 4 inches x 4 inches or on individual coupons that are about 2 inch x 4 inch and ¼ inch thick. Suggested rods for this class of position welds for AC and DC straight or reverse polarity is, first E-6013, second E-7014 and E-6010 for DC reverse polarity only.
2. Welds should be cleaned with a chipping hammer and wire brush. Apply a coat of light oil (penetrating oil) to the metal to prevent rusting. Wipe off excess oil.
3. 4-H Welding Project Tips and Suggestions: Class 3 & 4 1. All welds should be cleaned and protected from rust with paint or light oil. Plans are to be complete enough that if they were given to a welding shop, the item could be made without further instructions. Bill of materials should include a cost for all items used including steel, electrodes, paint, wheels, etc.

PREMIUM	Purple	Blue	Red	White
	\$4.00	\$3.00	\$2.50	\$2.00

### Arcs and Sparks

**H920-001 Welding Joints** (SF281) a display of one butt, one lap and one fillet weld.

**H920-002 Position Welds** (SF281) a display showing three beads welded in the vertical down, horizontal and overhead positions.

**H92003 Welding Art** (SF283) any art created using tack welds to hold the metal pieces together (examples include horseshoe projects). Type of welder, welder settings, all plans, plan alterations, and a bill for material must be



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attached to the article. Protect plans with a cover. If the project is designed to be outside, it is required to have appropriate outdoor finish.

PREMIUM	Purple	Blue	Red	White
	\$10.00	\$8.50	\$7.00	\$5.50

**H920-004 Welding Article** (SF281) any shop article where welding is used in construction. 60% of the item must be completed by 4-H'er and notes regarding laser welding or machine welding must be included. Type of welder, welder settings, all plans, plan alterations, and a bill for material must be attached to the article. Protect plans with a cover. If the project is designed to be outside, it is required to have appropriate outdoor finish because the project may be displayed outside.

**H920-005 Welding Furniture** (SF282) any furniture with 75% welding is used in the construction. 60% of the item must be completed by 4-H'er and notes regarding laser welding or machine welding must be included. Type of welder, welder settings, all plans, plan alterations, and a bill for material must be attached to the article. Protect plans with a cover. If project is designed to be outside, it is required to have appropriate outdoor finish because project may be displayed outside

**H920-006 Plasma Cutter/Welder Design** (SF279) Plasma cutters/welders allowed for detailed design(s) to butt cut into metal. 4Hers will create a notebook describing the design process to create the "artwork" to butt cut into the metal.

In the notebook include:

- A photo (front and back) of the finished project.
- Instructions on how the design was created, this allows for replication of the project.
- Lessons learned or improvements to the project.
- Steps to finish the project.

**H920-007 Composite Weld Project** (SF280) 60% of the project must be welded and 40% made from other materials such as wood, rubber, etc. Type of welder, welder settings, all plans, plan alterations, and a bill for material must be attached to the article. Protect plans with a cover. If the project is designed to be outside, it is required to have appropriate outdoor finish because the project may be displayed outside.

**H920-901 Welded Article**

### STEM Woodworking

In this category 4-H'ers have the opportunity to create exhibits about varying levels of woodworking. In addition, participants can also create informational exhibits about their woodworking projects. Through involvement in this category 4-H'ers will be better educated about the topic and better their woodworking skills.



#### Rules

- The name of each exhibitor should appear separately on the back of each board, poster or article and on the front cover of the notebooks so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
- Requirements: All articles exhibited must include a plan (with drawings or sketch or blueprints) stating dimensions and other critical instructions a builder would need to know how to build the project. Plans may include narrative instructions in addition to the dimension drawings and include any alterations to the original plan. Part of the score depends on how well the project matches the plans. If the plans are modified, the changes from the original need to be noted on the plans. All plans used for making the article must be securely attached and protected by a clear plastic cover.
- 4-H'ers must be in Unit 3 or Unit 4 for the exhibit to be considered for State Fair. All projects must have an appropriate finish.
- If the project (i.e. picnic tables, wishing wells, swings, chairs, bridges, doghouses, etc.) is designed to be used outside, it will be displayed outside.
- All outside projects MUST have an entry tag and supporting information placed in a protective bag to prevent damage from weather events such as rain and be ATTACHED to projects with string, zip ties, etc.

Eligibility- All static exhibits must have received a purple ribbon at the county fair to advance to the State Fair

PREMIUM	Purple	Blue	Red	White
	\$4.00	\$3.00	\$2.50	\$2.00

#### Measuring Up: Unit 1

**H911-901 Articles Made with Hand Tools** Select from Unit I (new manual or use comparable plans from other sources)

**H911-902 Woodworking Display** Display exemplifying one of the principles learned in the Measuring Up Project. Examples include: tools, safety, wood types, glues, sanding tips, finishing methods.

#### Making the Cut: Unit 2

Awards will only be given to the top purple ribbon winner in each of the curriculum areas. Entry must earn a purple ribbon to earn awards and rosettes. All static exhibits must have received a purple ribbon at the county fair to advance to the State Fair. Classes that are listed as a "900" number (last 3 digits of the class number) are Hamilton County Fair only exhibits and are not eligible to advance to the Nebraska State Fair, regardless of ribbon placement. County only entries are still eligible for County Awards.

**H-911-903 Article** as shown in Woodworking Unit 2 Manual or comparable items using power hand tools, electric jig saw, power drill, and/or oscillating sander.

**H911-904 Woodworking Display** Display exemplifying one of the principles learned in the Making the cut Project. Examples include: tools, safety, wood types, cutting on the angle, finishing methods.

PREMIUM	Purple	Blue	Red	White
	\$8.00	\$7.00	\$6.00	\$5.00

### **Nailing it Together: Unit 3**

**H911-001 Woodworking Article** (SF91) Item should be made using either joints, hinges, dowels, or a dado joining made using skills learned in the Nailing It Together manual. Items are required to be appropriately finished.

Examples include: bookcase, coffee table or end table.

**H911-003 Recycled Woodworking Display** (SF95) Article made from recycled, reclaimed or composite wood.

Article must be appropriately finished **and/or sealed** and utilize one or more woodworking techniques from page 2 of the Unit 3 manual. Exhibit must include the woodworking plan and a minimum one-page report of how the engineering design process was used to develop the woodworking plan. Engineering Design Process

1. State the problem (Why did you need this item?)
2. Generate possible solutions (How have others solved the problem? What other alternatives or designs were considered?) \_
3. Select a solution (How does your solution compare on the basis of cost, availability, and functionality?)
4. Build the item (What was your woodworking plan, and what processes did you use to build your item?)
5. Reason for article finish (What type of finish, how did you finish or why you choose this finish?)
6. Evaluate (How does your item solve the original need?)
7. Present results (How would you do this better next time?)

**H911-004 Composite Wood Project** (SF96) 60% of the project must be wood and 40% made from other materials such as metal, rubber, resin, etc. All plans and plan alterations must be attached to the article. Protect plans with a cover. If the project is designed to be outside, it is required to have appropriate outdoor finish because the project may be displayed outside.

**H911-005 Outdoor Wood Project made with Treated Wood** (SF97) Treated wood projects DO NOT have to have a finished coating. All plans and plan alterations must be attached to the article. Protect plans with a cover. If the project is designed to be outside. Examples include: picnic tables, planters, outdoor furniture, etc.

**H911-006 Wood Projects created on a Turning Lathe** (SF) Article is the object created from spinning wood on a turning lathe. Article must be appropriately finished and/or sealed. Exhibit must include plans detailing design and process of completion, any changes made to the design, details of finishing techniques, and other relevant information about the article. Must include a description of tools used.

PREMIUM	Purple	Blue	Red	White
		\$10.00	\$8.50	\$7.00

\$5.50

### **Finishing Up: Unit 4**

**H911-007 Woodworking Article** (SF91) Item made using skills learned in the Finishing It Up Project. Examples include: dovetailing, making a pen using lathe, overlays, using a router, etc. Items are required to be appropriately finished.

**H911-008 Recycled Woodworking Display** (SF91) Article made from recycled, reclaimed or composite wood.

Article must be appropriately finished **and/or sealed** and utilize one or more woodworking techniques from page 2 of the Unit 4 manual. Exhibit must include the woodworking plan and a minimum one-page report of how the design and engineering process was used to develop the woodworking plan.

1. State the problem (Why did you need this item?)
2. Generate possible solutions (How have others solved the problem? What other alternatives or designs were considered?)
3. Select a solution (How does your solution compare on the basis of cost, availability, and functionality?)
4. Reason for article finish (What type of finish, how did you finish or why you choose this finish?)
5. Build the item (What was your woodworking plan, and what processes did you use to build your item?)
6. Evaluate (How does your item solve the original need?)
7. Present results (How would you do this better next time?)