

# SCIENCE, ENGINEERING & TECHNOLOGY

(AEROSPACE, COMPUTERS, ELECTRICITY, ROBOTICS, GEOSPATIAL, PHYSICS, LEGO BUILDING, SMALL ENGINES, ENERGY, PHYSICS/POWER OF WIND, WOODWORKING, WELDING)

See General Rules pg. 2 for additional information. (Please note Ineligible Exhibits.)

All static exhibits must receive a purple at the county fair to advance to the State Fair.

SCIENCE, ENGINEERING & TECHNOLOGY exhibits are eligible for the PREMIER 4-H SCIENCE AWARD offered at State Fair. See pg. 5 for details.

## GENERAL INFORMATION & EXHIBITING RULES – SCIENCE, ENGINEERING & TECHNOLOGY

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 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. Please refer to the General Rules for the policy regarding use of copywritten images and regarding firearms, items with a blade and other related items.
5. Posters can be any size up to 28" by 22" when ready for display. Example: tri fold poster boards are not 28" x 22" when fully open for display.
6. Fabricated board such as plywood, composition board, or particle-type lumber may be used for demonstration displays.
7. Demonstration boards should be sanded and finished to improve their appearance. The finish on a demonstration board will be judged as a woodworking exhibit. (State Fair eligible class only)

## AEROSPACE (ROCKETS/DRONES)

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 SET Aerospace gives participants a first-hand experience in modern technology. For help getting started with this project contact your county 4-H office.

## ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES - AEROSPACE

1. Rockets must be supported substantially to protect the rocket from breakage. Rockets are to be mounted on a base that has dimensions equal or less than 12" x 12" and the base should be 3/4" thick. No metal bases. If the rocket fins extend beyond the edges of the required base (12" x 12"), then construct a base that is large enough to protect the fins. The base size is dictated by the size of the rocket fins.
2. 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 rockets engine mount to give added stability.
3. 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.
4. 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.
5. The flight record should describe 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 show on the rocket. Complete factory assembled rockets will not be accepted at the State Fair.
6. 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.

7. For self-designed rockets only, please include digital recorded copy of one flight. In the documentation, please include a description of stability testing before the rocket was flown.
8. Skill level of project is not determined by number of years in project. Skill level is determined by the level listed on the manufacturing packaging.
9. 4-H Rocket project levels are not intended to correspond to National Association of Rocketry model rocket difficulty ratings or levels.
10. **High power rockets (HPR) is 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.**
11. Youth enrolled in Aerospace 2, 3, or 4 may exhibit in any class within this division.

## DEPARTMENT H - DIVISION 850 - AEROSPACE (ROCKETS/DRONES)

Division 850 Classes 001, 003-004, 006

Pay Category A

Division 850 Classes 002, 005

Pay Category L

- SF)CLASS 001** **Rocket** - Any Skill Level Rocket with wooden fins and cardboard body tubes painted by hand or air brush. (SF92)
- SF)CLASS 002** **Aerospace Display** - 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, explains the parts of a NASA rocket or shuttle, interview of someone in the aerospace field, or kite terminology. Include notebook containing terminology (definition), and what was learned. Display can be any size up to 28" by 22". (SF93)
- SF)CLASS 003** **Rocket** - Any Skill Level Rocket with wooden fins and cardboard body tubes painted using commercial application, example commercial spray paint. (SF92)
- SF)CLASS 004** **Rocket** - Any **self-designed rocket** with wooden fins and cardboard tubes. (SF92)
- SF)CLASS 005** **Drone Poster** - 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" by 22".
- SF)CLASS 006** **Drone Video** - 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, and drones used for structural engineering. Video should not exceed 5 minutes. Videos should be uploaded to a video streaming application and exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors are encouraged to test their codes or links on several devices to check for appropriate permissions. (For State Fair: Videos should be submitted to <https://go.unl.edu/2023nesfset> by August 15, 2023 Amy Timmerman at [atimmerman2@unl.edu](mailto:atimmerman2@unl.edu) by August 15th, 2022.)

## 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 SET Computers gives participants a first-hand experience in modern technology. For help getting started with this project contact your county 4-H extension office.

### ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES – COMPUTERS

1. Be sure to follow General Information guidelines A – G (see pg. 109).

## DEPARTMENT H - DIVISION 860 - COMPUTERS

Division 860 Classes 001-007, 901-904

Pay Category L

### COMPUTER MYSTERIES - UNIT I - BOOTING UP

- C)CLASS 901** **Poster** - Create a poster on a lesson learned in Unit 1. Examples might include: hardware, software programs, how to take care of a computer and operating systems.
- C)CLASS 902** **Computer Application** – 4-H exhibitor should use computer application to create a graphic notebook utilizing computer technology. 4-H'er may create any of the following: greeting card (5 different cards should be 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) 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.

**C)CLASS 903**

**Create a Scrapbook or Poster** - Put together a scrapbook or poster on a topic that you have investigated on the Web. The topic can be anything such as dinosaurs, space, favorite TV stars, music, science fiction characters, sports cars, fun vacation spots, etc. Print off the information you found on the Web and display it in a scrapbook or on a poster.

**C)CLASS 904**

**Storybook** - Write a story and illustrate it with pictures. Pictures can be original drawings, clip art or photos. Put it all together in a storybook format.

**COMPUTER MYSTERIES – UNIT 2 – ADDING ON**

**SF)CLASS 001**

**Computer Application Notebook** – 4-H exhibitor should use computer application to create a graphic notebook utilizing computer technology. 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) 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. (SF277)

**SF)CLASS 002**

**Produce a Computer Slideshow Presentation** – 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 no 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 presenter. ~~Files must be saved in a PC compatible format with county name and last name of participant before emailing OR the slide show may be shared through a share link or QR code which is included in the notebook.~~ All slideshows must be uploaded to a video streaming application and exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors are encouraged to test their codes or links on several devices to check for appropriate permissions. (SF276) (For State Fair: ~~All slide shows should be emailed to Amy Timmerman, [atimmerman2@unl.edu](mailto:atimmerman2@unl.edu), before August 15. Entries should be submitted to <https://go.unl.edu/2023nesfset> by August 15, 2023.~~)

**COMPUTER MYSTERIES - UNIT 3 - REACHING BEYOND**

**SF)CLASS 003**

**Produce an Audio/Video Computer Presentation** – 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. 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. ~~The presentation must be able to be played and viewed on a PC using Windows Media Player, Real Player, iTunes or QuickTime Player. (All presentations for State Fair should be emailed to Amy Timmerman, [atimmerman2@unl.edu](mailto:atimmerman2@unl.edu), before August 15. OR the presentation can also be uploaded to a video streaming application and exhibitors must provide a hard copy QR code for viewing.)~~ The presentation should be uploaded to a video streaming application and exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors are encouraged to test their codes or links on several devices to check for appropriate permissions. (SF276) (For State Fair: ~~All slide shows should be emailed to Amy Timmerman, [atimmerman2@unl.edu](mailto:atimmerman2@unl.edu), before August 15. Entries should be submitted to <https://go.unl.edu/2023nesfset> by August 15, 2023.~~) (SF276)

**SF)CLASS 004**

**How to STEM (Science, Technology, Engineering and Math) Presentation**– 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. ~~Entries should be uploaded to a video streaming application and exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors are encouraged to test their codes or links on several devices to check for appropriate permissions. (SF276) (For State Fair: All slide shows should be emailed to Amy Timmerman, [atimmerman2@unl.edu](mailto:atimmerman2@unl.edu), before August 15. Entries should be submitted to <https://go.unl.edu/2023nesfset> by August 15, 2023.) Videos should be designed for web viewing or may be uploaded to a video streaming application and exhibitors can provide a hard copy QR code for public viewing. Any of the following formats will be accepted: .mpeg,~~

.rm, .wmv, .mp4, .mov, .ppt, or .avi. (SF276)

**SF)CLASS 005 Virtual Platform Presentation** – Youth design a fully automated education presentation (video, notebook, poster, etc.). Videos should be uploaded to a video streaming application and exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors are encouraged to test their codes or links on several devices to check for appropriate permissions. (SF276) (For State Fair: Entries should be submitted to <https://go.unl.edu/2023nesfset> by August 15, 2023.)

**SF)CLASS 0056 Create a Web Site/Blog or App** – Design a simple Web site/ blog or app for providing information about a topic related to youth using either software programs such as an HTML editor like Microsoft's FrontPage or Macromedia's Dreamweaver, and image editor like IrfanView or GIMP OR online using a WIKI such as Google Sites. If the Web site, Blog, or App isn't live include all files comprising the Web site, Blog or App should be submitted on a flash drive in a plastic case along with the explanation of why the site was created or may be shared through a hard copy share link or QR code for viewing. If developed using a WIKI or other online tool include a link to the website in the explanation of why the site was created. (For State Fair: Entries should be submitted to <https://go.unl.edu/2023nesfset> by August 15, 2023, or videos can be uploaded to a video streaming application and exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors are encouraged to test their codes or links on several devices to check for appropriate permissions.) (SF275)

**SF)CLASS 0067 3D Printing** – 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. (SF1050)

Must include design notebook that addresses the following questions:

- a. 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?
- b. 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 multiples, 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 and make thicker external walls, or to have a denser infill.)
- c. 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)?
- d. What materials were selected for your project?
- e. If your final design has any moving parts, define how you determined appropriate allowance in your design.
- f. Identify any changes that you would make to improve your design.

**SF)CLASS 0078 Maker Space/Digital Fabrication** –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 corel draw or Fusion 360 would be an example of an appropriate software used to create your finished project. (SF1051)

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 the project
- d. Prototype of plans
- e. Cost of creating project
- f. Iterations or modifications made to original plans
- g. Changes you would make if you remade the project

Team Entries: To qualify for entry at the Nebraska State Fair team materials entered in this class 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.

## ELECTRICITY

In this category 4-H'ers have the opportunity to create information 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.

## GENERAL RULES – ELECTRICITY

1. Be sure to follow General Information guidelines A – G (see pg. 109).

## DEPARTMENT H - DIVISION 870 - ELECTRICITY

Division 870 Classes 001-008, 901-906, 910-912

Pay Category L

- C)CLASS 901** **Electrical Safety Poster** - Must deal with a specific topic. Examples are: "Overhead Power Line Safety," "Electrical Safety in the Home," "On the Farm Safety."
- C)CLASS 902** **Electric Energy Conservation Poster** - Must show useful methods of efficient use of electrical energy and conservation.

### MAGIC OF ELECTRICITY - UNIT 1

- C)CLASS 903** **Bright Lights** - Create your own flash light using items found around your house. Flash lights should be made out of items that could be recycled or reused. No kits please.
- C)CLASS 904** **Control the Flow** - Make a switch. Use the following items 1) D cell battery, 2) battery holder, 3) insulated wire, 4) 2 or 2.5 volt light bulb, 5) bulb holder, 6) paper clip, 7) cardboard, and 8) two brass paper fasteners to create a circuit that you can open and close.
- C)CLASS 905** **Conducting Things** - Make a circuit with a switch and a light bulb that can be used to test different items for their ability to act as an insulator or conductor. You must find five items that are conductors and five items that are insulators. Create a table that illustrates your results.
- C)CLASS 906** **Is There a Fork In the Road?** - Use the following items to construct one parallel and one series circuit. Items 1) D cell battery, 2) battery holder, 3) insulated wire, 4) bulb holder, and 5) 2 or 2.5 volt light bulb.

### INVESTIGATING ELECTRICITY - UNIT 2

- C)CLASS 910** **Case of the Switching Circuit** - Use the following items: 1) two D cell batteries, 2) two battery holders, 3) light bulb, 4) bulb holder, 5) a 3" x 6" piece of cardboard, 6) six brass paper fasteners, and 7) two feet of 24 gauge insulated wire to build a three way switch. Write a short essay or create a poster that illustrates how three way switches function.
- C)CLASS 911** **Rocket Launcher** - Construct a rocket launcher out of the following materials: 1) a plastic pencil box that is at least 4" x 8", 2) single pole switch, 3) single throw switch, 4) normally-open push button switch, 5) 40 feet of 18 or 22 gauge stranded wire, 6) four alligator clips, 7) a 2"x6" board 6 inches long, 8) 1/8 inch diameter metal rod, 9) rosin core solder, 10) soldering iron or gun, 11) wire stripper, 12) small crescent wrench, 13) pliers, 14) small Phillips and straight blade screwdrivers, 15) drill 16) 1/8" and 1/4" drill bits, 17) rocket engine igniters, 18) 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.
- C)CLASS 912** **Stop the Crime** - Build an ALARM using the following materials: 1) on-off push button switch, 2) mercury switch, 3) buzzer-vibrating or piezoelectric, 4) battery, 9 volt, 5) 9 volt battery holder 6) 4" x 4" by 1/8" Plexiglass board to mount circuit on, 7) rosin core solder, 8) soldering gun/iron, 9) two feet of 22 gauge wire, 10) wire strippers, 11) hot glue sticks, 12) hot glue gun, and 13) 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.

### WIRED FOR POWER - UNIT 3

- SF)CLASS 001** **Electrical Tool/Supply Kit** - 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)
- SF)CLASS 002** **Lighting Comparison** - Display studying the efficiency of various lighting (incandescent, fluorescent, halogen, Light Emitting Diodes, etc.). Exhibit could be a poster display, or an actual item. (SF225)
- SF)CLASS 003** **Electrical Display/Item** - 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. (SF226)
- SF)CLASS 004** **Poster** - Should exemplify one of the lessons learned in the Wired for Power Project. Posters can be any size up to 28" x 22". (SF227)

## ELECTRONICS - UNIT 4

- SF)CLASS 005** **Electrical/Electronic Part Identification** - Display different parts used for electrical/electronics work. Exhibit should show the part (either picture or actual item) and give a brief description, including symbol of each part and its function. Display should include a minimum of 10 different parts. (SF228)
- SF)CLASS 006** **Electronic Display** - Show an application of one of the concepts learned in the Electronics project. Examples include: components of an electronic device (refer to p.35 of the Electronic manual). (SF229)
- SF)CLASS 007** **Electronic Project** - Exhibit an electronic item designed by the 4-Her or from a manufactured kit that shows the electronic expertise of the 4-Her. Examples include: a radio, a computer, or a volt meter. (SF230)
- SF)CLASS 008** **Poster** - Should exemplify one of the lessons learned in the Entering Electronics Project. Posters can be any size up to 28" x 22". (SF231)

## 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 SET Robotics gives participants a first-hand experience in modern technology.

### ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES – ROBOTICS

1. Be sure to follow General Information guidelines A – G (see pg. 109).
2. Youth enrolled in Virtual Robotics, Junk Drawer Robotics (Levels 1, 2, or 3), or Robotics Platforms may exhibit in any class within this division.
3. **Team Entries:** To qualify for entry at the county fair and 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.
4. Creating a video of your robot in action would be helpful for the judges but is not mandatory. Present as a CD Rom with your robot entry.

## DEPARTMENT H - DIVISION 861 - ROBOTICS

Division 861 Classes 001-008

Pay Category L

- SF)CLASS 001** **Robotics Poster** – Create a poster (28"x22") 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-Her. (SF236)
- SF)CLASS 002** **Robotics Notebook** – 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-Her's learning experience. The notebook should contain at least three pages. Topics could include a programming challenge, a programming skill, calibration, sensor exploration or any of the topics suggested in Class 1. (SF237)
- SF)CLASS 003** **Robotics Video** – This class should be displayed in a notebook. The notebook should include a video clip on a CD/DVD that demonstrates the robot performing the programmed function. Include your pseudo code and screenshots of the actual code with a written description of the icon/command functions. All videos for State Fair should be emailed to Amy Timmerman, [atimmerman2@unl.edu](mailto:atimmerman2@unl.edu), before August 16. Files must be saved in a PC compatible format with county name and last name of participant before emailing.
- SF)CLASS 004** **Robotics/Careers Interview** - Interview someone who is working in the field of robotics and research the career in robotics. Interviews can either be written or in a multimedia format (CD/DVD). Written interviews should be in a notebook. Written reports should be 3 to 5 pages, double-spaced, 12-point font and 1" margins. Multimedia reports should be 3 to 5 minutes in length. (SF239)
- SF)CLASS 005** **Robotic Sensor Notebook** – Write pseudo code which includes at least **three one** sensor activity. Include the code written and explain the code function. (SF241)
- SF)CLASS 007** **Kit Labeled Robot (cannot be programmed) and Notebook** – 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:
- a. A description of what the robot does,
  - b. Pictures of programs the robot can perform,
  - c. Why they chose to build this particular form, and

d. How they problem solved any issues they might have had during building and programming. A picture of assembly is recommended. If robot is more than 15" inches wide and 20" inches tall they may not be displayed in locked cases. (SF243)

**SF)CLASS 008**

**3D Printed Robotics Parts** - 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 notebook describing the process used to create the project, describe the success of your designed piece (did it work), intended use of the product and the modifications made to the item. (SF244)

## GEOSPATIAL

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.

### ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES – GEOSPATIAL

1. Be sure to follow General Information guidelines A – G (see pg. 109).
2. Youth enrolled in Geospatial may exhibit in any class within this division.

### DEPARTMENT H – DIVISION 880 – GEOSPATIAL

Division 880 Classes 001-007

Pay Category L

**SF)CLASS 001**

**Poster** – Create a poster (not to exceed 14" x 22") 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 or GIS in Agriculture," "Precision Agriculture," or a geospatial topic of interest. (SF299)

**SF)CLASS 002**

**4-H Favorite Place or Historical Site Poster** – 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" x 22". (SF299)

**SF)CLASS 003**

**GPS Notebook** – 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. (SF300)

**SF)CLASS 004**

**Geocache** – Assemble a themed geocache. Each geocache should be a watertight 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 and include a printout of its registry.** The entry may include a photograph of the cache in its intended hiding place. (SF301)

**SF)CLASS 005**

**Agriculture Precision Mapping** – 4-Hers 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. (SF302)

**SF)CLASS 006**

**4-H History Map/Preserve 4-H History:** Nominate a Point of Interest for the 4-H History Map Project. Include copy of submitted form in 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://4hhistorypreservation.com/History\\_Map/](http://4hhistorypreservation.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 historical significance of 4-H place or person. (a minimum of one paragraph) (SF303)

**SF)CLASS 007**

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

**SF)CLASS 008**

**Virtual Geocache** – 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.

# LEGO BUILDING

## ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES – LEGO BUILDING

1. Be sure to follow General Information guidelines A – G (see pg. 109).
2. Each exhibit must have name and age attached.
3. Include information on how the exhibit will be used.
4. Display on a board so the exhibit may be moved easily. (Board will not be judged.)
5. The Extension Office & Nemaha County Ag Society will strive to exhibit the models safely but we will not be responsible for items lost.
6. The exhibits in LEGO Building are educational exhibits. Exhibitors may use whatever means is most effective in showing what they have accomplished in a project they have planned themselves.
7. Youth are allowed only 1 exhibit per class and may only exhibit in 2 classes in this division. Youth will choose one of the two exhibits for interview judging. Only exhibits that goes through the interview process will be eligible for TOP Award in this division.

## DEPARTMENT H - DIVISION 881 - LEGO BUILDING

Division 881 Classes 901-904

Pay Category L

**LEGO Building Exhibit (Model)** - An exhibit that is made from a model or a set design giving the directions on construction

- C)CLASS 901      **LEGO Model (500 pieces or less)**  
C)CLASS 902      **LEGO Model (501 pieces or more)**

**LEGO Building Exhibit (Original)** - An exhibit that is original and is not made from a set design of plans or a model.

- C)CLASS 903      **LEGO Model Original (500 pieces or less)**  
C)CLASS 904      **LEGO Original (501 pieces or more)**

# SMALL ENGINES

## ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES – SMALL ENGINES

2. Be sure to follow General Information guidelines A – G (see pg. 109).

## DEPARTMENT H - DIVISION 890 - SMALL ENGINES

Division 890 Classes 901-903

Pay Category L

### CRANK IT UP – UNIT 1

- C)CLASS 901      **Small Engine Display/Item** - Show an application of one of the concepts learned in the unit one project. Examples include: identify the parts of a small engine, safety rules for starting a small engine, small engine repair tool identification.

### WARM IT UP – UNIT 2

- C)CLASS 902      **Small Engine Display/Item** - Show an application of one of the concepts learned in the Warm It Up project. Examples include: comparison of engine oil types, transmissions, or safety related to engines. Exhibit could be a poster display, or an actual item.

### TUNE IT UP – UNIT 3

- C)CLASS 903      **Small Engine Display/Item** - Display/Item should exemplify one of the lessons learned in the Tune It Up Project. Examples include: diagnostic tools, fuel systems, ignition systems. If a complete engine is exhibited it will not be started. However, display needs to report process of building/rebuilding engine and how/where engine will be utilized (i.e. lawn mower, weed eater, snow blower, etc.).

# ENERGY

This category provides 4-H'ers a way to present their ideas about renewable energy sources. 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. For help getting started with this project contact your county 4-H office.

## ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES – ENERGY



1. Be sure to follow General Information guidelines A – G (see pg. 109).

**2. Renewable Energy Resources:**

- United States Department of Energy: <https://www.energy.gov/clean-energy>
- U.S. Energy Information Administration: <https://www.eia.gov/energyexplained/renewable-sources/>
- Natural Resources Defense Council: <https://www.nrdc.org/stories/renewable-energy-clean-facts>

**DEPARTMENT H – DIVISION 895 – 4 WHEELIN’** (Age: Beginner to Intermediate)

Division 895 Classes 901-904

Pay Category L

- C)CLASS 901** **Project Book** – Complete 4 Wheelin’ project book.
- C)CLASS 902** **Poster** - Exhibit with six photos demonstrating the experiments in the 4-H manual.
- C)CLASS 903** **Tool Box** - Assemble a tool box using guidelines from the 4 Wheelin’ manual. Include a description and a list of individual contents.
- C)CLASS 904** **Poster** - Show something learned about physics or safety from the 4 Wheelin’ project.

**DEPARTMENT H - DIVISION 900 – ENERGY**

Division 900 Classes 001-006, 902-904

Pay Category L

- SF)CLASS 001** **Create and Compare Energy Resources Poster** – 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” by 22.” (SF307)
- SF)CLASS 002** **Experiment Notebook** – 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. (SF305)
- SF)CLASS 003** **Solar as Energy Display/Poster** - Item should be the original design of the 4-Her. Include the item, or a picture if item is in excess of 6’ tall or 2’ X 2’. Include a notebook of why the item was designed and how it harnesses the power of the sun. Examples include solar ovens, solar panels, etc. (SF308)
- SF)CLASS 004** **Water as Energy Display/Poster** -- Item should be the original design of the 4-Her. Include the item, or a picture if item is in excess of 6’ tall or 2’ X 2’. Include a notebook of why the item was designed and how it harnesses the power of water. (SF308)
- SF)CLASS 005** **Wind as Energy Display/Poster** – Item should be the original design of the 4-Her. Include the item, or a picture if item is in excess of 6’ tall or 2’ X 2’. Include a notebook of why the item was designed and how it harnesses the power of wind. (SF308)
- SF)CLASS 006** **Other Nebraska Alternative Energy**–Notebook should explore Nebraska 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, methane reactors, etc.** (SF306)
- C)CLASS 902** **Wind Poster** – Poster should exemplify one of the lessons learned in the Power of Wind project. Posters can be any size up to 14" by 22". (SF307)
- C)CLASS 903** **Mini Turbine Blade Energy Display** – Develop a pinwheel display that demonstrates the working power of wind. Follow guidelines on page 18 and 19 of your manual. Display should include a notebook description of the effectiveness of at least three different designs or materials. Please do not include pennies with your display. (SF306)
- C)CLASS 904** **Wind Art or Literature Written Piece** – Item should illustrate or represent wind turbines, wind power, or something from the power of wind curriculum, for example a pinwheel or item may be original story or poem written by the exhibitor about wind. (SF304)

## 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.

### ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES – WOODWORKING

1. Be sure to follow General Information guidelines A – G (see pg. 109).
2. The ability to build objects as designed by another person is an important life skill. Professional woodworkers often are hired to build objects to exacting specifications as laid out in a written plan.

3. **Requirements:** All articles exhibited *must include a plan (with drawings or sketch or blueprint)* stating dimensions and other critical instructions a builder would need to know how to build the project and **4-Her's name & county**. Plans may include narrative instructions in addition to the dimension drawings and include any alternations 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. 4-Hers must be in Unit 3 or Unit 4 for the exhibit to be considered for State Fair. All projects must have appropriate finish.
5. 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 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.**

## DEPARTMENT H - DIVISION 910 - WOODWORKING UNITS 1 & 2

Division 910 Classes 901–902, 905-906

Pay Category L

### MEASURING UP - UNIT 1

Develop skills such as measuring, squaring, and cutting a board, driving nails, and using clamps and screws. Build a picture frame, a letter holder, a box, or an airplane.

- C)CLASS 901**      **Woodworking 1 Article** - Item made using skills learned in the Measuring Up Project Guide. Examples include: recipe holder, stilts or other skill level appropriate item.
- C)CLASS 902**      **Other Woodworking 1 Article (Self-Designed and Other Plans)** - Comparable to other items made in Unit 1, using hand tools.

### MAKING THE CUT – UNIT 2

Measure, cut, sand, drill, and use advanced hand and power tools. Apply paint and use bolts and staples. Build a sawhorse, birdhouse, tool box, or a stool.

- C)CLASS 905**      **Woodworking 2 Article** - Item made using skills learned in the Making the Cut project guide. Examples include: birdhouse, foot stool, napkin or letter holder.
- C)CLASS 906**      **Other Woodworking 2 Article** - Other article as shown in the Making the Cut manual or comparable.

## DEPARTMENT H - DIVISION 911 - WOODWORKING UNITS 3 & 4

Division 911 Classes 001–008, 907-908

Pay Category A

### NAILING IT TOGETHER - UNIT 3

Practice measuring angles, cutting dado and rabbet joints. Use a circular saw, a table saw, and a radial arm saw. Sand and stain wood.

- SF)CLASS 001**      **Woodworking 3 Article** - Item should be made using either joints, hinges, dowels, or a dado joining made using skills learned in the Nailing It Together manual. Item is required to be appropriately finished. Examples include: bookcase, coffee table or end table. (SF91)
- SF)CLASS 003**      **Recycled Woodworking Display** – 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. (SF91) Engineering Design Process
- State the problem (Why did you need this item?)
  - Generate possible solutions (How have others solved the problem? What other alternatives or designs were considered?)
  - Select a solution (How does your solution compare on the basis of cost, availability, and functionality?)
  - Build the item (What was your woodworking plan, and what processes did you use to build your item?)
  - Reason for article finish (What type of finish, how did you finish or why you choose this finish?)
  - Evaluate (How does your item solve the original need?)
  - Present results (How would you do this better next time?)
- SF)CLASS 004**      **Composite Wood Project** - 60% of the project must be wood and 40% made from other materials such as metal, rubber, resin, etc. All plans and plan alternations 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. (SF96)
- SF)CLASS 005**      **Outdoor Wood Project made with Treated Wood** - Treated wood projects DO NOT have to have a finished coating. All plans and plan alternations must be attached to the article. Protect plans with a

cover. If project is designed to be outside. Examples include: picnic tables, planters, outdoor furniture, etc. (SF97)

**C)CLASS 907**

**Woodworking 3 Display** - Display exemplifying one of the principles learned in the Nailing it Together Project. Examples include: measuring angles, wood lamination and joint types. (SF91)

**FINISHING UP - UNIT 4**

**SF)CLASS 006**

**Woodworking 4 Article** - Item made using skills learned in the Finishing it Up Project. Examples include: dovetailing, making a pen using lathe, overlays, using a router, etc. Item is required to be appropriately finished. (SF91)

**SF)CLASS 008**

**Recycled Woodworking Display** – 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. (SF91)

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

**C)CLASS 908**

**Woodworking 4 Display** - Display exemplifying one of the principles learned in the Finishing it Up Project. Examples include: career opportunities, types of finishes, or dovetailing. (SF91)

## WELDING

Learn to cut metal with an arc solder. Weld high carbon, spring steel and alloy steels. Weld horizontal, vertical, and overhead positions.

### ADDITIONAL GENERAL INFORMATION & EXHIBITING RULES – WELDING

1. Be sure to follow General Information guidelines A – G (see pg. 109).
2. All welds exhibited in class 1 or 2 must be mounted on a 12" high x 15" long display board of thickness not to exceed 3/8". 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 display board so it can be hung like a picture frame.
3. If no plans are included with welding art, welding article, welding furniture, or composite weld project, item will be disqualified.
4. **Class 1: 4-H Welding Project Tips and Suggestions**
  - All welds should be made with the same electrode/wire/rod size and number.
  - Welds should be made only on one side of metal so penetration can be judged.
  - Welds should be cleaned with chipping hammer and wire brush. Apply a coat of light oil (penetrating oil) to the metal to prevent rusting; wipe off excess oil.
  - It is suggested that all welds be of the same size and thickness of metal. These pieces, referred to as coupons, should be 1 ½ " to 2" wide and 3 ½ " to 4" 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.
  - Stick welding: Suggested coupon thickness - 1/4" if using 1/8" rod. Suggested rod-AC and DC straight or reverse polarity-first E-7014, second E-6013
  - MIG welding: Suggested coupon thickness-1/4" if using .035 wire and 1/8" if using .023 wire
  - Oxy-Acetylene: Suggested coupon thickness- 1/8"mmnn Suggested rod- 1/8" mild steel rod
5. **Class 2: 4-H Welding Project Tips and Suggestions**
  - 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" x 4" or on individual coupons that are about 2" x 4" inch and 1/4" 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.

- 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.

6. **Classes 3 & 4: 4-H Welding Project Tips and Suggestions**

- 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.

7. **Class 901: 4-H Welding Project Tips and Suggestions**

- Each display board shall be 18" x 24" x 3/8".
- Welding boards shall identify:
  - Kind of Weld
  - Position
  - Amperage
  - Electrode size
  - AWS number
  - Thickness or dimensions of metal
- A total of 8 welds are recommended:
  - Butt – flat, horizontal, vertical
  - Fillet – horizontal, vertical
  - Lap – flat, horizontal, vertical
- Welds shall be attached so all sides are available for evaluation. Judges will deduct points if welds are mounted solid. No specific welds are required; however, welds must differ from one another by at least position, electrode size, AWS number, thickness or dimension of metal, or kind of weld.

**DEPARTMENT H - DIVISION 920 – WELDING**

Division 920 Classes 001–007, 901

Pay Category A

- SF)CLASS 001** **Welding Joints** - A display of one butt, one lap and one fillet weld. (SF281)
- SF)CLASS 002** **Position Welds** - A display showing three beads welded in the vertical down, horizontal and overhead positions. (SF281)
- SF)CLASS 003** **Welding Art** – 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 attached to the article. Protect plans with a cover. If project is designed to be outside, it is required to have appropriate outdoor finish. (SF283)
- SF)CLASS 004** **Welding Article** – Any shop article where welding is used **in the** construction. 60% of item must be completed by 4-Her and notes regarding laser welding or machine welding must be included. Type of welder, welder settings, all plans, plan alterations, and a bill for materials must be attached to the article. Project 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. (SF281)
- SF)CLASS 005** **Welding Furniture** – Any furniture with 75% welding is used in the construction. 60% of item must be completed by 4-Her 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. Project 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. (SF282)
- SF)CLASS 006** **Plasma Cutter/Welder Design**– Plasma cutters/welders allowed for detailed design(s) to butt cut into metal. 4-H members will create a notebook describing the design process to create the “artwork” to butt cut into the metal. In the notebook include:
  - a. A photo (front and back) of the finished project.
  - b. Instructions on how the design was created (include software used), this allows for replication of the project.
  - c. Lessons learned or improvements to the project.
  - d. Steps to finish the project.
- SF)CLASS 007** **Composite Weld Project** - 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 project is designed to be outside, it is required to have appropriate outdoor finish because project may be displayed outside. (SF280)
- C)CLASS 901** **Position Welds** -a display showing eight joints welded in the vertical, flat, or horizontal positions.