

SCIENCE & TECHNOLOGY

CHECK IN:

Wednesday, July 10, 2024 from 6:30 - 8:30 p.m.

& Thursday, July 11, 2024 from 7:30 – 8:30 a.m.

JUDGING TIME:

Thursday, July 11, 2024, 9:00 a.m. (closed to public)

ENTOMOLOGY

ENTOMOLOGY GUIDELINES

- Awards will be determined on the basis of the variety of insects in the collection, correctness of identification and overall neatness.
- Specimens need to be mounted properly and labeled with the date and location of collection, name of collector, and order name. Follow mounting and labeling instructions in the Nebraska 4-H Entomology Manual (<http://4hcurriculum.unl.edu/catalog/entomemntal.html>).
- Purchased insects and other insects not collected by the participant can be included, but must have accurate labels and will not be counted in meeting minimum requirements for the exhibit. Boxes to be not more than 12" high x 18" wide.

DEPT. H / DIV. 800

ENTOMOLOGY

Class 1 Entomology Display / First Year Project: collection to consist of 25 or more different kinds (species) of insects representing at least 6 orders. Limit one box.

Class 2 Entomology Display / Second Year Project: collection to consist of a minimum of 50 kinds (species) of insects representing at least 8 orders. Replace damaged or poorly mounted specimens. At least 25 species must be from after July 1 of the previous year. Limit 2 boxes.

Class 3 Entomology Display / Third or More Year Project: collection to consist of a minimum of 75 kinds (species) of insects representing at least 10 orders. Replace damaged or poorly mounted specimens. At least 25 species must be present from after July 1 of previous year. Limit 3 boxes.

Class 4 Special Interest or Advanced Insect Display: Educational display developed according to personal interests and / or advanced identification capability. This also is an opportunity to highlight favorite insects in a creative arrangement. Insects should conform to pinning and mounting standards as in class 1-3 and be protected in an insect box. Each specialty display should include names of the insects, interesting information about them and why the display was made. Advanced identification collections should have insects grouped with labels that correspond with identification level (e.g. family, genus, species). A specialty collection may consist of insects by taxonomic group (e.g. butterflies, grasshoppers, dragonflies, scarab beetles) or by host, subject or habitat (e.g. insect pests of corn, aquatic insects, insect mimicry, insect galls, insects from goldenrod, insect pollinators, etc.).

Class 5 Insect Habitats: Habitats consist of any hand-crafted objects, made of natural or artificial materials, placed outdoors, which promote or conserve insects in the environment. Insects may include bee pollinators, butterflies, beneficial insects, etc. A one-page report describing activities must accompany the exhibit. Report Should include placement, target insect, why materials were chosen, functional design, and indicators of success. See the following resources for reports:

- Nebraska Extension NebGuide: Creating Solitary Bee Hotel
- Nation Wildlife Federation: How to Provide Water in Monarch Gardens

Class 6 Macro Photography: Subjects should be insects, spiders or other arthropods, or any nests, webs or constructions they made. All exhibit prints should be either 8" x 10" or 8 ½"x11" and mounted on rigid, black 11"x14" poster or matt board. Either orientation is acceptable. No frames or mat

board framing is allowed. A caption of a few sentences should explain the subject, and be printed on white paper, and glued below the print on the poster board.

Class 7 Insect Poster/Display Exhibits: Exhibits can be posters or three – dimensional displays, and artistic creativity is encouraged. Posters should be no larger than 22” x 28”. They should be instructional and can be attractive and have pictures, drawings, charts, or graphs. Posters and displays may show any aspect of insect life, habitat, or related conservation or management. Examples include life history and other facts about an insect; insect anatomy; how to manage insects in a farm, home, lawn, or garden setting; experiences rearing one kind of insect; survey of an important insect; insect behavior (ex. Nesting, finding food, mobility, defenses, etc.); habitats (e.g. forests, grasslands, wetlands, rivers, or lakes) and what insects are found there, etc. Three-dimensional displays, such as dioramas, sculptures, models or decorative boxes should have a page of explanatory information accompanying them and fit within a 22” x 28” area.

Class 8 Reports or Journals: Reports and journals should be in a three-ring binder. A report may be informational, that is, an original article about a favorite insect, a history of insect outbreaks, diseases caused by insects, insects as food, etc. Or, it may be a research report about an investigation or experiment done in a scientific manner. It then should have a basic introduction of the insect studied, methods used, observations, and results of the project. Tables, graphs and images are helpful to include. A journal is an observational study over a period of time with personal impressions. It may cover watching changes in kinds of butterflies over the summer, rearing a specific insect from egg to adult, managing a beehive, observations of insects in a specific habitat, accounts of insect behavior in a forest or flower garden, etc.

VETERINARY SCIENCE

VETERINARY GUIDELINES

- The purpose of the Veterinary Science exhibit is to inform the public about a common health problem of animals or a veterinary science principle.
- A Veterinary Science exhibit may consist of a poster or a display. The exhibit may represent material from any of the Veterinary Science projects including entry level exhibits from Unit I.
- If photographs are to be part of the exhibit, remember that they will be viewed by the public. Make sure that the photographs are in good taste and will not be offensive to anyone. Graphic photographs of excessive bleeding, trauma or painful procedures are not appropriate. For exhibits related to veterinary surgical procedures, aseptic techniques need to be shown, for example, use of drapes, use of sterile procedures, wearing of gloves, and other appropriate veterinary medical practices.
- **First-Aid Kits:** Because of public safety concerns and risk of theft of first-aid kits contents (veterinary drugs/equipment) with perceived potential for drug abuse, animal first aid kits containing any drugs or medications will be immediately disqualified and not displayed. First Aid kits wishing to include medication information should instead utilize written descriptions, photographs, drawings, computer generated print-outs, or empty packaging of pharmaceuticals.
- **Veterinary Science Posters:** This exhibit presents the viewer with a design that is simple and direct, unlike a display that usually presents more information. A poster should not exceed 22” x 28” and may be either vertical or horizontal.
- **Veterinary Science Displays:** A display may include but is not limited to: a 3-dimensional exhibit, a scale model, the actual product (for example: skeleton; teeth; samples of leather, fur, or dried skin damaged by disease or parasites) or a notebook. A display is not a poster. A display may be mounted on poster board not to exceed 22” x 28” or on ¼” plywood or equivalent that does not exceed 24” high or 32” wide.
- **Appropriate Veterinary Science Topics:**
 - Maintaining health
 - Specific disease information
 - Photographic display of normal and abnormal characteristics of animals

- Animal health or safety
- Public health or safety
- Proper animal management to ensure food safety & quality
- Efficient and safe livestock working facilities
- Or a topic of the exhibitors choosing related to veterinary medicine or veterinary science

Remember, since these are science displays, all references and information needs to be properly cited. Proper sources include but are not limited to: Professional journals and publications, professional AVMA accredited websites, interviews with Veterinarians and excerpts from Veterinary Educational Literature. Plagiarism will result in a disqualification. Please study your topic and present the information to your audience in your own words.

DEPT. H / DIV. 840 VETERINARY SCIENCE

Class 1 4-H Veterinary Science Large Animal Poster, Notebook or Display

Class 2 4-H Veterinary Science Small Animal/Pet Poster, Notebook or Display

ENGINEERING

ENGINEERING GUIDELINES

- A. The name and county of each exhibitor should appear separately on the back of each board, article and set of plans so the owner of the exhibit may be identified if the entry tag is separated from the exhibit.
- B. Each individual is limited to ONE exhibit per class.
- C. Several classes require a display board with a height of 24 inches and not to exceed 1/4" in 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 x 8 sheet of plywood. Nothing should be mounted within 3/4 inch of the top or bottom of the board. (Example: Woodworking, Small Engines, & Electricity).
- D. Fabricated boards such as plywood, composition boards, or particle-type lumber may be used for demonstration displays.
- E. Demonstration boards could be sanded and finished to improve their appearance. The finish on a demonstration board is not to be judged as critically as a woodworking exhibit.
- F. Demonstration boards should include an overall title for the display, plus other necessary labeling.
- G. 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.

STEM ROCKETS

AEROSPACE GUIDELINES

1. Rockets should be supported substantially to protect it from breakage. Rockets should 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"x12"), 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 rocket's engine mount to give added stability.

3. Rockets must be equipped as prepared for launching, with wadding and parachute or other recovery systems.
4. Rockets entered with live engines, wrong base size or sideboards will be disqualified.
5. A report, protected in clear plastic cover, should 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 show on the rocket. Complete factory assembled rockets will not be accepted.
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.
 - √ 4-H Rocket project levels are not intended to correspond to the National Association of Rocketry model rocket difficulty ratings or levels.
 - √ Skill level of the project is not determined by the number of years in the project. Skill level is determined by the level listed on the manufacturing packaging.
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. Poster can be any size up to 28" x 22" when ready for display. Example: tri fold poster boards are not 28" x 22" when fully open for display.

DEPT. H / DIV. 850

Aerospace/Rockets

Youth enrolled in Aerospace 2, 3, or 4 may exhibit in any class within this division.

Class 1 Rocket: Any skill level Rocket with wooden fins and cardboard body tubes painted by hand or air brush.

Class 2 Aerospace Display: Poster or display board that displays exemplifies one of the principles learned in the Lift Off project. Examples include: display of rocket parts and purpose, explaining the parts of 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".

Class 3 Rocket: Any Skill Level Rocket with wooden fins and cardboard body tubes painted using commercial application example commercial spray paint.

Class 4 Self-Designed Rocket: Any self-designed rocket with wooden fins and cardboard body tubes.

Drones

Class 5 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"x22".

Class 6 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, drones used for structural engineering. Video should not exceed 5 minutes.

STEM COMPUTERS

COMPUTER GUIDELINES

All Computer Projects containing Email addresses need to black out personal Email addresses for the protection of each exhibitor.

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 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.

DEPT. H / DIV. 860

Computer Mysteries: Unit 2

Class 1 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 should 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 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 print out of your project. Project may be in color or black and white.

Class 2 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 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. Entries can be uploaded to a cloud sharing service and exhibitors MUST provide a hard copy QR code for viewing. Exhibitors should test their codes or links on several devices to check for appropriate permissions for public viewing.

Computer Mysteries: Unit 3

Class 3 Produce an Audio/Video Computer Presentation – 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. Exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors should test their codes or links on several devices to check for appropriate permissions for public viewing.

Class 4 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-Her, 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. Exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors should test their codes or links on several devices to check for appropriate permissions for public viewing.

Class 5 Virtual Platform Presentation - 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. Exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors should test their codes or links on several devices to check for appropriate permissions for public viewing.

Class 6 Create a Website/Blog or App – Design a simple website, 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 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. Entries can be uploaded to a cloud sharing service. Exhibitors **MUST** provide a hard copy QR code for viewing. Exhibitors should test their codes or links on several devices to check for appropriate permissions for public viewing.

Class 7 3D Printing – 3D printing uses plastic or other materials to build a 3 dimensional object from a digital design. Youth may use original designs or someone else’s they have re-designed 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 robots or other engineering projects or cookie cutters. Must include design notebook with motivation or problem statement the prototype was 3D printing will include a notebook with the following:

1. What was the motivation for your design or the problem you were solving with your design? ie. 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 replaced 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.

Class 8 Maker Space/Digital Fabrication – The 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 appropriate software used to create your finished project. Project should include a notebook with the following:

- What motivated you to create this project
- Software and equipment used
- Directions on how to create the project
- Prototype of plans
- Cost of creating project

- Alterations or modifications made to original plans
- Changes you would make if you remade the project

STEM ELECTRICITY

DEPT. H / DIV. 870 ELECTRICITY

POSTERS: The following 4-H electricity related posters (classes 901 and 902) exhibiting and judging should refer to Department B, Division 152, Posters, for general requirements.

Class 901 Electricity Safety Poster: Must deal with a specific topic. EXAMPLE: "Overhead Power Line Safety," "Safety In The Home", "On Farm Safety." Exhibits in this class are NOT eligible to go on to the State Fair.

Class 902 Electric Energy Conservation: Must show useful methods of efficient use of electrical energy and conservation. Exhibits in this class are NOT eligible to go on to the State Fair.

ELECTRICITY CLASSES: The following 4-H Electricity Exhibits should refer to the 4-H Electricity Manuals for general guidelines.

Electricity– UNIT 1

Class 903 Bright Lights: Create your own flashlight using items found around your house. Flashlights should be made out of items that could be recycled or reused. No kits please.

Class 904 Control the Flow: Make a switch. Use the following items: D cell battery, battery holder, insulated wire, 2 or 2.5-volt light bulb, bulb holder, paper clip, cardboard, and two brass paper fasteners to create a circuit that you can open and close.

Class 905 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 conductors and five items that are insulators. Create a table that illustrates your results.

Class 906 Is There a Fork in the Road: Use the following items to construct one parallel and one series circuit. Items: D cell battery, battery holder, insulated wire, bulb holder and a 2 or 2.5 volt light bulb.

Electricity – UNIT 2

Class 907 Case of the Switching Circuit: Use the following items: two D cell batteries, two battery holders, light bulb, bulb holder, a 3 inch by 6 inch piece of cardboard, six brass paper fasteners and approx. 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.

Class 908 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- by 6- 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.

Class 909 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 inch by 4 inch by 1/8 inch Plexiglass board to mount circuit on; rosin core solder, soldering gun/iron, two feet of 22-gauge wire, wire strippers, hot glue gun 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.

Electricity – Wired for Power – UNIT 3

Class 1 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. Containers should be appropriate to hold items.

Class 2 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.

Class 3 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.

Class 4 Poster should exemplify one of the lessons learned in the Wired for Power Project. Posters can be any size up to 28” by 22”.

Electronics – UNIT 4

Class 5 Electrical/Electronic Part Identification: Display different parts used for electrical/electronic work. Exhibits 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.

Class 6 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 Entering Electronic manual).

Class 7 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 voltmeter.

Class 8 Poster should exemplify one of the lessons learned in the Entering Electronics project. Posters can be any size up to 28” by 22”.

STEM WOODWORKING

WOODWORKING GUIDELINES

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. 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. Plans may include narrative instructions in addition to the dimension drawings. 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 attached and protected by a clear plastic cover and include the exhibitors name and county.

DEPT. H / DIV. 911

WOODWORKING

WOODWORKING WONDERS – UNIT 1

Class 904 Woodworking Article: Item made using skills learned in the Measuring Up manual. Examples include: flower box, napkin holder or letter holder, or picture frame.

Class 905 Woodworking Display: Display exemplifying one of the principles learning in the Measuring Up project. Examples include: name the tools, safety settings, identifying woods, measuring, butt joint, sanding.

WOODWORKING WONDERS – UNIT 2

Class 906 Woodworking Article: Item made using skills learned in the Making the Cut manual. Examples include: tool box, birdhouse, sawhorse, whistle, or footstool.

Class 907 Woodworking Display: Display exemplifying one of the principles learned in the Making the Cut project. Examples include: safety techniques, interviewing a carpenter, selecting wood, cutting on an angle, chiseling, scrolling, power sanding.

NAILING IT TOGETHER – UNIT 3

Class 1 Woodworking Article: Items 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.

Class 3 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. Exhibits 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:

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

Class 4 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 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.

Class 5 Outdoor Wood Project made with Treated Wood: Treated wood projects DO NOT have to have a finished coating. All plans and plan alterations must be attached to the article. Project plans with a cover. If the project is designed to be outside. Examples include: picnic tables, planters, outdoor furniture, etc.

Class 6 Wood Projects created on a Turning Lathe: Article is the object created from spinning wood on a turning lathe. Articles must be appropriately finished and/or sealed. Exhibits 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.

FINISHING UP – UNIT 4

Class 7 Woodworking 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. Items are required to be appropriately finished.

Class 8 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. Exhibits 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.

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

STEM WELDING

WELDING GUIDELINES

All metal welding processes are accepted. 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 stating:

- 1) type of welding process (stick, MIG, TIG, Oxy-Acetylene, etc.)
- 2) kind of weld
- 3) welder setting
- 4) electrode/wire/rod size
- 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.

If no plans are included with welding articles or welding furniture, items will be disqualified.

DEPT. H / DIV. 920

WELDING

Class 1 Welding Joints: A display of one butt, one lap and one fillet weld.

- 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 on the same size and thickness of 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.

Stick welding

Suggested coupon thickness – ¼" if using 1/8" rod

Suggest rod –AC and DC straight or reverse polarity –first E-7014, second E-6013

MIG welding

Suggested coupon thickness—1/4" is using .035 wire and " if using .023 wire

Oxy – Acetylene

Suggested coupon thickness—1/8"

Suggested rod – 1/8" mild steel rod

Class 2 Position Welds: A display showing 3 beads welded in the vertical down, horizontal and overhead positions.

- 1) It is suggested that all welds be 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 ¼" 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.

Class 3 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.

Class 4 Welding Article: Any shop article where welding is construction. 60% of the item must be completed by 4-Her and notes regarding laser welding or machine welding must be included. Type of welder settings, all plans, plan alteration, 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.

- 1) All welds should be cleaned and protected from rust with paint or light oil. Plans are to be complete enough
- 2) 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.

Class 5 Welding Furniture – any furniture with 75% welding is used in the construction. 60% of the item must be completed by 4-Her and notes regarding laser welding or machine welding must be included. Type of welder settings, all plans, plan alteration, 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.

- 1) All welds should be cleaned and protected from rust with paint or light oil. Plans are to be complete enough
- 2) 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.

Class 6 Plasma Cutter / Welder Design – Plasma cutters / welders allowed for detailed design(s) to butt cut into metal. 4-Hers 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, this allows for replication of the project.
- c) Lessons learned or improvements to the project.
- d) Steps to finish the project.

Class 7 Composite Weld Project: 60% of the project must be welded and 40% made from other materials such as wood, rubber, etc. Type of welder settings, all plans, plan alteration, 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.

STEM ROBOTICS

DEPT. H / DIV. 861 ROBOTICS

- Class 1 Robotics Poster – Create a poster (28”x 22”) communicating a robotics theme such as “Robot or Not”, “Pseudocode”, “Real World Robots”, “Careers in Robots” or “Autonomous Robotics”, “Precision Agriculture” or a robotic topic of interest to the 4-H’er.
- Class 2 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-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.
- Class 4 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 such as a short video uploaded to a cloud sharing service. Include a QR code with your project to allow for judging access. 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 for public viewing. Written interviews should be in a notebook. Written reports should be 3 to 5 pages, double spaced, 12-p[oint font, and 1 “ margins. Multimedia reports should be between 3 to 5 minutes in length.
- Class 5 Robotics Sensor Notebook – 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. Videos can also 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 public viewing.
- Class 7 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
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.
- Class 8 3D Printed Robotics Parts - This class is intended for youth to create parts, through 3D printing, to help create their robot or aid a robot in completing a coded function. Project should include a 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.

STEM GEOSPATIAL

DEPT. H / DIV. 880
GEOSPATIAL

Rule:

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.
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.

Youth enrolled in Geospatial or GEAR TECH 21 may exhibit in any class within this division.

- Class 1 Poster: Create a poster (not to exceed 14"x22") 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.
- Class 2 4-H Favorite Places or Historical Site Poster: The 4-H exhibitor identifies a favorite place or historical site (including grave sites) in Nebraska. Exhibits should include latitude and longitude, digital picture, and local area map. Poster size should not exceed 14" x 22".
- Class 3 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.
- Class 4 Geocache: Assemble a themed geocache (physical geocache is REQUIRED with exhibit).. 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, geo-coins, 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, include a print-out of its registry.** The entry may include a photograph of the cache in its intended hiding place.
- Class 5 Agriculture Precision Mapping: 4-Hers will assemble a notebook that will include a minimum of 2 digital copies of various data layering that can be used in precision agriculture to identify spatial patterns and / or correlations (printed copies of websites were applications can be purchased in acceptable) A report of how the analysis of the various data will be used to make management decision.
- Class 6 4-H History Map/Preserve 4-H History: Preserve 4-H History: Nominate a Point of Interest for the 4-H History Map Project including a 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/ 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)
- Class 7 GIS Thematic Map: 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, and or the 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", should include Title, Base Map, Neat Line, North Arrow, and Legend. Identify the source of your information on the back of the map.
- Class 8 Virtual Geocache - Keep a log of at least 5 places visited using a virtual geocach 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.
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STEM ENERGY

DEPT. H / DIV. 900

ENERGY

Rules

A. 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.

B. Each individual is limited to one exhibit per class.

C. 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.

Class 1 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".

Class 2 Experiment Notebook – Notebook will explore the scientific method involving alternative /renewable energy sources. Information required. 1) Hypothesis 2) Research 3) Experimental 4) Measure 5) Report or Redefine Hypothesis.

Class 3 Solar as Energy Display/Poster – Item should be the original design of the 4-Her. Include the item, or a picture if the item is in excess of 6' tall or 2'x2'. 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.

Class 4 Water as Energy Display/Poster – Item should be the original design of the 4-Her. Include the item, or a picture if the item is in excess of 6' tall or 2'x2'. Include a notebook of why the item was designed and how it harnesses the power of water.

Class 5 Wind as Energy Display/Poster – Item should be the original design of the 4-Her. Include the item, or a picture if the item is in excess of 6' tall or 2'x2'. Include a notebook of why the item was designed and how it harnesses the power of wind.

Class 6 Other Nebraska Alternative Energy – 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, methanew reactors, etc.