SECTION 17 – SCIENCE, TECHNOLOGY, ENGINEERING and MATH

Project Records are required for Youth Building entries.
A General Project Record or Cloverbud Project Record, plus an Exhibit Tag, must accompany each exhibit entered in the Youth Building. Copies of the General Project Record, Cloverbud Project Record, and Exhibit Tag can be obtained by contacting Cornell Cooperative Extension or by picking up copies at the Hamden office.

GENERAL GUIDELINES
All woodworking, electrical, electronic or computer projects will be judged on Sunday or Monday as they are brought to the Youth Building at fair and BEFORE they are displayed. Each exhibitor is responsible for presenting his or her exhibit to the judge.

Articles in this exhibit must have been made and selected according to 4-H standards during the current project year.

If power tools are used by youth in making projects, youth must be 11 years old or older.

Up to two articles per class, per member, may be entered in this section.

If project was made in a school shop class, indicate on the General Project Record.

Birdhouses entered in wood science classes will be evaluated under wood science standards. Superintendents may move birdhouses to the wildlife class under Environmental Education section, if appropriate.

WOOD SCIENCE PROJECTS
CLASS NUMBERS

2250 **Hand Tool Division**
Article made in a Wood Science project that was cut out, assembled and finished with hand tools only.

2251 **Power Tool Division**
Article made in a Wood Science Project that has been partially or totally completed with power tools.

2252 **Kit Division**
Article made in a Wood Science Project that is made from materials precut by an outside resource (Example: Extension 4-H office, commercial supplier or woodworking volunteer leader) but is assembled and finished by the exhibitor. Judges will place emphasis on quality of woodworking performed by exhibitor. No commercial names on exhibit.

2253 **Reclaimed Lumber**
Must state origin of lumber or wood used. Project will be evaluated according to woodworking standards.

2254 **Recycled Wood Projects**
Made from pre-existing items made into a new usable form (Example: bed headboard into a bench). Project will be evaluated according to woodworking standards.

2255 **Wood Science or Shop Work Open Class**
Article made in Wood Science Project that does not fit in above categories. Judges will place emphasis on quality of workmanship by exhibitor and the intended use of the project. Exhibits to be entered in this division will be at the discretion of the Extension 4-H Educator.

ELECTRICAL SCIENCE PROJECTS
CLASS NUMBERS

2260 **Electric Division**

Article in an Electric Project, such as cords, pin-up or study lamp, or the rewiring of an old lamp is acceptable. Tension restraint device must be in place especially in lamp sockets. Where appropriate underwriters knot should be used. Due to safety code compliance, molded polarized and or prefabricated cords with polarized plugs, where applicable are allowed. Lamps without bulbs or shades will not be considered complete and will be evaluated accordingly. Projects involving both woodworking and electrical task will be evaluated on the merits of both.

2261 **Electronics Division**

Article made in an Electric Project utilizing principles and construction procedures relating to electronics is acceptable. Projects will be evaluated on the basis of soldering and connection techniques, neatness of assembly and other assembly procedures for electronic projects. Projects must be hand-wired and no breadboard kits will be accepted. Project must be operable (Example: contain all necessary batteries). Include a short explanation of why or how the exhibit works and what use it has.

EDUCATIONAL DISPLAYS
CLASS NUMBER

2265 **A Series of Posters (at least 14 by 22 inches) or a**
3-Dimensional Exhibit Related to an Engineering Science Project

Display should be self-explanatory through use of signs or labels and limited to approximately card table size. Topics may include such things as engine parts or bicycle parts display boards, electric circuit boards, electric quiz games, computer project display, or safety rules for bicycling or working in a wood shop or with electricity. Entry will be evaluated on the purpose or principle idea, effectiveness in illustrating one idea, appearance, arrangement, and description of the display. Exhibit must be self-explanatory.

ROCKET PROGRAM
CLASS NUMBERS

2270 **Junior Division**

Any rocket made in a Rocket Program either from a kit or non-kit materials and totally assembled and finished by a youth 13 years of age or younger. Evaluators will place emphasis on proper kit assembly and finishing.

2271 **Senior Division**

Any rocket made from non-kit materials and totally constructed and finished by a youth 14 years and older. Emphasis placed on proper construction techniques and finished product. Kits may be used when incorporated with other materials to meet the requirements on an Educational Display as outlined in class number 2265.

RELATED ENGINEERING SCIENCE PROJECTS
CLASS NUMBER

2272 **Related Engineering Science Projects**

Any article made as a part of a directly related Engineering Science project, such as metal working, cardboard carpentry, or safety items and not included in Class 2250 thru 2271.

Kits not acceptable for Senior Division entries (14 years and over).

SCIENCE EXPERIMENTS and EXHIBITS

An opportunity for participants to learn about and experience science concepts in an area of agriculture, human ecology or life sciences that the participant really enjoys. Individual or group entries are encouraged.

Below are some examples of types of projects you may conduct. Any type or combination of types of science projects below along with creativity is encouraged.

CLASS NUMBERS

2275 **Citizen Science**

Is the engagement of public participants in real-world scientific collaborations – asking questions, collecting data, and interpreting results. A display or record of participation in a Citizen Science project, could be part of a local, regional, national or international project, but needs to include some kind of connection to scientists, researchers, or policy makers and contribute to scientific knowledge that will be put to some type of use (by researcher, policy makers, etc.). Examples include: Wasp Watchers, Project Feeder Watch, eBird, Lost Ladybug, Adopt a Pixel, Nature's Notebook, or a local project.

2276 **Experiments**

Describe your hypothesis (what you think will happen). Describe the procedures you performed. Describe the observations you made and what conclusions you drew from your experiment. Include photos or drawings and samples (if possible) from your experiment. If it is difficult to recreate the study for the exhibit, drawings or photographs are acceptable. Use heavy poster paper (14 by 22 inches minimum) as a background. Attach photos and diagrams, along with sheets of paper that include your experiment description within these sections: 1. introduction; 2. hypothesis; 3. methods; 4. results; and 5. your conclusion.

2277 **Public Service and Civic Engagement Projects**

Exhibits can be any public service or public education activity you took part in that has a scientific component to it. Watershed rehabilitation, recycling programs and educational models are just a few of the possibilities here. Project exhibit posters must be clearly labeled with a written statement of what the project is, how it relates to science, and why you are interested in the project.

3D PRINTING

3D printing uses plastic or other materials to build a 3-dimenstional object from a digital design. Youth may use original designs or someone else's they have re-designed in a unique way. Youth must bring their finished printed object (we cannot print objects at Fair).

Exhibits will be judged based on the complexity of the design and shape. Must include the following:

a. Software used to create 3-D design.
b. Design, or if using a re-design, the original design and the youth's design with changes.
c. Orientation that the object was printed.

CLASS NUMBERS

2280 **3-D Prototypes**
3-D objects printed as part of the design process for robot or other engineering project. Must include statement of what design question the prototype was supposed to answer and what was learned from the prototype.

2281 **3-D Unique Objects**
3-D objects printed for their own sake. May be an art design, tool, or other object.

2282 **Descriptive Science**
Science projects which are not experiments and are not applied service projects but do consist of systematic observations and tell us about the natural world. Exhibit could show summaries of what you observed (how the local bird population changes with the seasons, where flies like to breed in a barn, how many bites of food different animals eat per minute, etc.). Could present collections and classifications of materials which display physical or biological articles.

GEOSPATIAL SCIENCE

Exhibits that show skills and knowledge learned through 4-H GPS and GIS projects.

GIS Maps – Maps made using ESRI (Environmental Systems Research Institute, Inc.), are GIS software or other mapping software. Criteria and Guidelines for Community Mapping Projects can be found on New York State 4-H web page. GIS map exhibits may be selected for a display competition sponsored by NIFA and National Geographic Society.

CLASS NUMBERS

2285 **GIS or GPS Project or Activity**
May be undertaken by individual or group. Exhibit may be in the form of a project record book, photo documentation, video, CD, DVD, etc.

Exhibit must include project record documenting statement of purpose and outcome of project activity.

2286 **Story or Outline of a 4-H GIS or GPS Project**
Including photos, purpose of activity and summary, or results.

2287 **Community Service or Youth Community Action Mapping Project**
A mapping or GPS project built around a specific community issue or project.

2288 **Educational Poster Displaying 4-H GPS or GIS Activities**

2289 **Public Presentation on 4-H and Geospatial Sciences**

2290 **Geospatial Science Open Class**

CONSTRUCTION PROJECTS and MANUFACTURED COMPONENTS

Youth entering projects in the following classes use manufactured construction pieces to complete projects. Examples are Lego, K'nex, Brio, and Mechano, but projects are not limited to these examples. Projects can incorporate design, following instructions, three-dimensional thinking, design modifications, problem solving, creativity, architecture, structural design, principles of mechanics and use of color in the planning and design process. These skills relate to the professions of engineering, science, construction, architecture and art.

Judging will be based on completion, complexity, presentation and explanation of design, understanding of principles and visual presentations. Must include the following:

Number of Pieces – Youth must know the approximate number of pieces used in assembly. For kits, this number is on the box. It is understood that after a long creative process, it may be difficult to know exact number of small pieces; the youth must provide an estimate rounded to 25.

Diagrams – Diagrams are required. A diagram could be a photograph printed on printer paper, a scale drawing on graph paper, a photocopy of an instruction sheet or a variable scale rough drawing. Relevant labels and explanations must be added. The diagram must include:

1. Name of youth
2. The title of the project
3. The exact or approximate number of pieces and a self-judgment of complexity level (easy, less than one-hour assembly; medium, 1 to 3 hours construction time; or complex, more than 3 hours of construction time).

Juniors may use a photocopy of kit provided drawings for the basis of their diagrams, but brand logo must be covered and not visible. The diagram can be displayed in a plastic stand, mounted on poster board, or attached in a folder. Art value, ability of written work to attract, use of color and use of font add to design presentation.

Protection – Youth may prepare a display box for the project. There is no evaluation or points for this box; it is merely protection. A simple box could be a cardboard box with two sides removed and replaced with clear plastic.

CLASS NUMBERS

2295 **Kit**

This category is restricted to Juniors, ages 8 to 13. Juniors are limited to two projects in this class. If two projects are entered, they must differ significantly (Example: a creature, a building, or a vehicle). Youth must enter a completed kit. Original story must describe design process and describing play with the model. Judging criteria includes: completion, complexity (number of pieces), diagram (of the completed model and key elements labeled), explanation or story (explanation of the design process, difficulties and interesting elements; describe plan value, imaginative play, what steps could be taken to improve model) and overall presentations.

2296 **Original Model**

Youth are limited to two projects in this class, projects must differ significantly. The project can be a scene, diorama, model, building, vehicle, plant or creature. Judging criteria includes: completion design (number of pieces, moving parts-gear systems, axle systems (wheels), hidden entrances, pulleys, joints, projectiles and hinged components; unity of design-originality, use of color, symmetry of creativity, fully developed concept diagrams-comprehensive and detailed: an overall diagram of the completed model with key elements labeled, of moving parts or independent component; explanation, story or written report of the design process, difficulties encountered and their solutions, description of play value, future expansion of project and overall presentation.

2297 **Model Demonstrating a Mechanical Science Concept**

Projects must be original (no kits) and can include level arms, gears, pulleys, friction, belts, airfoils (flight, wine), catapults and load bearing bridges and beams. Science concepts can include energy transfer, stress analysis, Newton's laws, gravity, etc. Entries in this class must include a working model, an equation describing a principle of science, a labeled diagram of the project and written explanation of the science involved. Evaluation will also include presentation and visual impact of the project. Youth may conduct experiments with model and provide results in written report. Judging criteria includes: working model that demonstrates a principle of mechanical science, must move or work as necessary; scientific equation that relates the principle, including clear definition of each term with equation displayed; labeled diagram provided that labels major parts of the model and also notes how parts or movement relates to equation; written report (no more than two pages) which explains the principle and how model illustrates the principle (may include additional page of experimental results using the model); written explanation that explains design and construction of the model, including any difficulties and, how they were overcome, description of the principle mechanical science that is demonstrated clear understanding of scientific principles and explanation of how the model illustrates principle; and overall visual impact of project as prepared for display, including attractiveness of display.

2298 **Transportation Design**

Applies transportation pieces such a Brio in which youth design a transportation system (road, railroad). Drawings are to be hand drawn. Judging criteria: presentation labeled with name of exhibitor and title of project to include schematic of system drawn to scale, roads, railroad and bridges clearly labeled or identified in the legend, seniors to use 11 by 17 inch drawing paper, must have fully developed concept, clear details, completeness of system (no dead ends) and show creativity; legend that explains the meaning of symbols such as roads, railroad, bridge, water, vegetation, buildings; written explanation that explains the design and the purpose of the system, problems encountered and their solution and directions project could take in the future; and overall presentation, visual impact as prepared for display and attractiveness.

RENEWABLE and SUSTAINABLE ENERGY and CLIMATE CHANGE

Exhibits in Renewable and Sustainable Energy and Climate Change:

Educational exhibits or displays describing your 4-H project work done in the areas of:

- Renewable Energy (solar, wind, geothermal, biofuels, hydro-electric)
- Energy Conservation (home, community, school)
- Tracking (or studying) Climate Change
- Activities or studies related to managing 'Carbon Footprints' in the environment.

Exhibits may consist of stationary or working models, posters, photo story display, or electronic media. Electronic media must be submitted on a storage device like CD or flash drive. Information must be included on media to indicate method of viewing the entry.

A short description of what was undertaken in the project, your experience and what you learned through the project must be included. This can be included in the entry itself or on the exhibitor's information card.

CLASS NUMBERS

2300 **Exhibits in Renewable and Sustainable Energy**

2301 **Climate Change**

2302 **Renewable and Sustainable Energy and Climate Change Open Class**

Any other approved 4-H project made as a part of a related 4-H project that does not fit any other class.

COMPUTER SCIENCE

All exhibits must include something visual, such as a poster or printed copy of a digital presentation, which will remain on display during the exhibition. Electronic equipment will only be used during the judging time and will not remain on display during the entire exhibit period.

Programs available online (such as Scratch) should include a link to the specific project youth have created.

CLASS NUMBERS

2305 **Beginning Programming**
Exhibit a simple program using Scratch (or other simple graphic programming language). The program should include eight different commands including looping and getting input from the keyboard and mouse.

2306 **Intermediate Programming**
Exhibit a program using Scratch (or other simple graphic programming) that you have downloaded from the internet and modified. Compare the two programs and demonstrate the changes you made to the original program; or create an animated storybook or video game using Scratch (or other simple graphic programming language).

2307 **Advanced Programming**
Exhibit an original program using a higher-level programming language such as Python, Javascript, C++, etc.

2308 **App Development**
Exhibit an original mobile app. Describe the purpose of the app and what inspired you to create it in the exhibit information statement.

MAKER and TINKER

An excellent project either solves a problem or creates something new. These projects invent, build or experiment on ideas and include science, technology, engineering, art and math (STEM) principles.

All exhibits must include something visual which will remain on display during the exhibition. Maker and Tinker project should communicate what problem is being solved or what new idea was created. Include a brief description of the exhibit that shows how the project uses materials to create something that is a contemporary useful and unique design. It is also important to explain what skills were developed while creating the product. Expensive electronic or other equipment will only be used during the judging time and will not remain on display during the entire exhibit period.

2310 **Maker and Tinker Inventions**
Exhibits should display how youth used the design process to bring their idea and invention to life. Exhibit may be the item the youth has created or a notebook, poster or other display that depicts their projects. Inventions may include elements from kits such as Arduino or Little Bits. Computer coding may be written by the exhibitor or someone else's code the exhibitor has modified. Exhibitor should cite the sources of any designs or codes they tinkered with to create their invention. Examples must include re-programming a top to do something different or adding circuitry (lights, sounds, etc.) to an existing item like a sweater. Ideas can be found at sites like: http://madezine.com/
http://www.instructables.com
http://makered.org/youngmakers/
http://tinkering.exploratorium.edu/

2311 **Junk Drawer Robotics**

All exhibits should be original designs made from everyday objects and materials. Exhibits with purchased kits will not be accepted. Robots should be designed to carry out a series of at least three actions automatically to accomplish a task. Examples are included in the 4-H Junk Drawer Robotics curriculum or Rube Goldberg Machine contests.