Section J – STEM (Science, Technology, Engineering & Mathematics)

General Information – Pertains to JA through JF

- Articles in this section must be made and selected according to standards from project curriculum, State 4-H Club Management and Volunteer Leader Handbook plus CCE Risk Management Guidelines.
- Articles in this section must have been made and selected during the current project year.
- If power tools are used by youth in making projects, youth must be 12 years or older.
- Up to two articles per class per member may be entered (Sections JA, JB and JC, Classes 1 and 2)
- For construction project, with manufactured components see Section JC

Section JC – ENGINEERING

ROCKET PROGRAM

Class No.

1. **Junior Division:** Any rocket made in a rocket program either from a kit or non-kit materials and assembled and finished by youth 13 years of age or younger. Evaluators will place emphasis on proper kit assembly and finishing.

2. **Senior Division:** Any rocket made from non-kit materials and totally constructed and finished by youth 14 years and older. Emphasis placed on proper construction techniques and finished project.

CONSTRUCTED PROJECTS WITH MANUFACTURED COMPONENTS

General Information: 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, and creativity, architecture, and 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 following:

a. 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.
b. Diagram: 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 explanation must be added. The diagram must include: 1. Name of youth; 2.The title of project; 3 the exact or approximate number of pieces and 4. A self-judgment of complexity level (a. easy – less than one hour to assemble; medium – 1-3 hours construction time or c. complex – more than 3 hours of construction time). Junior may use a photocopy of kit provided drawings for 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 or written work to attract, use of color and use of font add to design presentation.
c. 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.

3. **Kit:** Restricted to juniors (ages 8-13) and exhibitors are limited to two projects in this class. If two projects are entered, they must differ significantly. Youth must enter a completed kit. Original story must describe design process, and play with model. Judging criteria: completion, complexity (number of pieces), diagram (of completed model and key elements labeled), explanation/story (explanation of the design process, difficulties, and interesting elements; describe play value, what steps could be taken to improve model) and overall presentation.

Class No.

4. **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, plants or creature. Judging criteria: 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 completed model with key elements labeled, of moving part(s) or independent component; explanation/written report – of design process, difficulties encountered and their solutions, description of play value, future expansion of project and overall presentation.

5. **Model Demonstrating a Mechanical Science Concept:** Projects must be original, no kits and can include level arms, gears, pulleys, friction, belts, airfoils (flight, wind), 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 written report. Judging criteria: 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 2 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 principles of 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.

6. **Transportation Design:** applies transportation pieces such as 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, railroads and bridges clearly labeled or identified in the legend, seniors to use 11x17 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, railroads bridge, water, vegetation, buildings, written explanation that explains the design and 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.

3D PRINTING

General Information: 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. 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 3D 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 No.

7. **3D Prototypes** – 3D 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.

8. **3D Unique Objects** – 3D objects printed for their own sake. May be an art design, tool, or other object.

ENGINEERING EDUCATIONAL DISPLAYS

9. **Displays:** may be a series of posters and a 3-demensional 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 (but not limited to) engine parts or bicycle parts display boards, electric circuit boards, electric quiz games, safety rules for bicycling or working with wood or electricity. Entry will be evaluated on the purpose or principle idea, effectiveness in illustrating idea, appearance, arrangement and description of the display.

RELATED ENGINEERING PROJECTS

Any article made as part of a directly related Engineering Science project, such as metal working, cardboard carpentry, and safety items and not included in other classes. Counties may enter only ten articles in this class. Kits are not acceptable for senior division (14 years and over).