Kalamazoo County 4-H
Mechanical Science Project Guidelines

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Project Social Media: N/A

Project Objectives & Life Skills*

- Learn about the mechanical science used in daily life and how it works
- Learn about the science of how motors/electricity work and why it works.

- **Head**
  - Wise use of resources
  - Planning/organizing
  - Goal setting
  - Critical thinking
- **Heart**
  - Communication
  - Concern for others
  - Social skills
  - Accepting differences
- **Hands**
  - Leadership
  - Marketable skills
  - Self-motivation
  - Responsible citizenship
- **Health**
  - Self-responsibility
  - Personal safety
  - Self-discipline
  - Character

**note these life skills are just some examples of what 4-H members will learn in this project*

Additional Resources:

–Engines, Motors and Machines Shop 4-H Curriculum
–Car Anatomy
–Rev Up STEM Learning with Car Science Projects
–Early Cars: Fact Sheet | Smithsonian Institution
–Shop 4-H Electric Curriculum
–4-H Electronics Projects Archive - Nathan Petersen
–Additional links under project resources at the bottom of the page →Electric - 4-H Purdue Projects
–Electronics and Robotics STEM Projects
–Tractor Project Sheet--Illinois
–NASD - Tractor Safety: background information & activity book
–Welding Project Sheet--Illinois
–You Can Weld Electrically--4-H Curriculum
–4-H Nova Scotia Leader Resource Guide Welding Project
–American Welding Society

Mechanical Sciences

Guidelines:

Section D–Automotive

- Create an appropriate age poster about an automotive topic.
- Topic Example Ideas
    - Safety—Describe or explain one or more of the following: seatbelt safety and laws, car seat safety and laws, airbags, rear occupant alert systems or any other automobile safety feature.
    - Safety Systems—Describe the operation or intended use of tire pressure monitoring systems, collision warning systems, anti-lock brake system/electronic stability control, blind spot detection, or any other safety system on an automobile.
    - Types of Automobiles—Compare and contrast different types of automobiles (gas powered, diesel powered, propane powered, hydrogen powered, hybrid electric, plug in hybrid electric, etc.)
    - Basic Maintenance—Explain how to inspect and/or replace wiper blades, check tire pressure, inspect fluid levels, or explain preventative maintenance intervals or any other car care procedure. *Pictures/images showing the steps are recommended.
    - Advanced Maintenance—Explain dashboard instrument icons and warnings, maintenance intervals or any advanced maintenance procedure such as how to install spare tires or use tire mobility kit, how to change the oil and proper disposal of the waste, how to inspect and replace lights. *Pictures/images showing the steps are recommended.
    - History—Create a timeline showing how automobiles have evolved over time.

Section E–Electrical Science

- For this project the exhibit should be a poster, notebook or a 3-D object that shares your knowledge of the electrical sciences. Project should be more advanced from one year to the next.
- Beginner (1st and 2nd year)
    - Suggested learning activities
        - Learn about the basic tools for electrical work and how they work/keep workers safe
        - Learn about conductors, electricity and simple circuits.
        - Learn about the basics of wiring and the skills it takes.
        - Learn about electromagnetism and its uses in the world.
        - Learn about other topics in the electrical science field that interests you.
- Intermediate (3rd and 4th year)
    - Suggested learning activities
        - Learn about grounding, why it's done and how it works in a circuit.
        - Learn about safety in the electrical field.
        - Learn about the size of the equipment and conductors needed for different electrical circuits.
        - Learn about how an electric motor operates and how the motors are controlled.
        - Learn about the electrical requirements for lighting and how it operates with a lamp.
        - Learn about magnetism and what are its applications in the electrical field.
        - Learn about different electronic components, how they work and build an electronic circuit to enter into section F of this department.
        - Learn about other topics in the electrical science field that interests you.

- Advanced (5th year and beyond)
    - Suggested learning activities
        - Learn what common induction motors are and how they are controlled
        - Learn about the generation and distribution of electricity.
        - Learn about more advanced wiring and electric circuit skills.
        - Learn about electrical plans and how to make them.
        - Learn about resistance, capacitance and inductance and why they are important to electrical work.
        - Learn how a radio, amplifier, radio broadcaster, superheterodyne receiver, etc. operate.
        - Continue learning about other complex electronic equipment.
        - Learn about other topics in the electrical science field that interests you.

<u>Section F–Electronics</u>

- For this project, the exhibit should be a circuit that was created to do something. Each year the project should be more advanced than the previous year.
- A circuit diagram must accompany your project and include the correct circuitry symbols
- Project should be neat. Including the display, soldering, wires, etc.
- 4-H'er should be able to explain the what, why and how their project was created and how it works.
- Beginners (1st and 2nd year)
    - Suggested project ideas
        - Circuit board–6x6" series/parallel circuit
        - Electric motor
        - Magnetic powered shake flashlight
        - Other such projects of interest
- Intermediate (3rd and 4th year)
    - Suggested project ideas
        - Build an extension cord
        - Rewire a lamp
        - Game board
        - Radio
        - Insect trap
        - Other such projects of interest
- Advanced (5th year and beyond)
    - Suggested project ideas
        - Build a lamp
        - Phonograph
        - Reverse switch for an electric chick brooder motor
        - Quiz board
        - Game board
        - Heated dog/pet house
        - Other such projects of interest

Section G–Small Engines

- 2 cycle or 4 cycle engine poster showing ideas learned
    - Make a display board about a topic learned on a 2 or 4 cycle engine. Examples below.
        - Fundamentals of preventive maintenance.
        - Become familiar with engine parts and learn how these parts function together as a unit.
        - Become familiar with proper use of hand tools.
        - Learn to use an operator's manual.
        - Learn two-stroke cycle engine principles.
        - Learn four-stroke cycle engine principles.
        - Learn how to buy the right engine and equipment for the job.
        - Investigate alternative fuel sources.
        - Learn the ways motors have had an impact on our society.
        - Become aware of career opportunities in fields related to petroleum power.
- Engine plus story telling what happened (reconditioning, parts replaced, etc.)
    - Two or 4 cycle engines - tune-up, maintenance work, or minor repairs such as replacing spark plugs, replacing oil, replacing points and setting, adjusting carburetor, clean and paint engine (except muffler), etc. Also clearly understand engine operating principles.
    - Project must include a detailed report of what work the 4-H'er did to the engine.
    - The engine will be tested when brought in for judging.
- Engine power application (show project worked on, i.e. grinder, generator, saw, compressor, etc.)
    - Two (2) or 4 cycle engine - major repairs such as replacing valves or grinding, engine block repairs, piston work, rebuilding carburetor, any internal engine repairs, etc.
    - Project must include a detailed report of what work the 4-H'er did to the engine.
    - The engine will be tested when brought in for judging.
- Completely overhauled engine with story of reconditioning, Adjustments, etc.
    - Rebuild one or more major components of any type of engine.
    - Project must include a detailed report of what work the 4-H'er did to the engine.
    - The engine will be tested when brought in for judging.

Section H–Tractor

- For this project the exhibit should be a poster, notebook, video or a 3-D object that shares your knowledge of the electrical sciences. Project should be more advanced from one year to the next.
- If a video is created, you must bring a laptop or other such device to show the judges your project.
- This class is to learn about tractor care and safety. The content and complexity of the exhibit should reflect the age of the 4-H'er as well as the time spent in this project.
    - Suggested learning activities
        - learn skills to handle and care for different tractors and farm machinery.
        - Understand the fundamentals of motors and different machinery
        - Be able to understand an operator's manual and be able to identify the different parts of a tractor or other farm machinery.
        - Take a Tractor operators course (offered in St. Joe, Calhoun and Berrien Counties)
        - Participate in tours of a tractor or machinery manufacturing plant.
        - Understand and know the trouble shooting techniques for engine trouble.
        - Know and become familiar with machinery management along with using it to determine cost of operations
        - Learn about safe tractor and fuel storage practices.
        - What winter care is needed for tractors and other farming equipment/machinery.
        - Know and understand the fundamentals of preventive maintenance and what the cost of not keeping up on preventive maintenance is.

Section I–Welding

- **The welding project is only allowed for 4-H'ers who are 11 years of age or older and only one project is allowed to be entered per year.**
- Projects exhibited in this class should be designed for practical use or artistic purposes and must demonstrate the skills and techniques learned during the project year. Each project year the exhibit should be more challenging than the previous year.
- All 4-H'ers, parents and leaders need to wear proper attire for welding including a welding helmet when welding or in observance of someone welding.
- Review the welding curriculum
    - You Can Weld Electrically--4-H Curriculum
    - 4-H Nova Scotia Leader Resource Guide Welding Project
- **First Year Goals:**
    - 1. To acquaint the 4-H member with the skills and knowledge of basic welding.
    - 2. To acquire a working knowledge of the machines and equipment used in the welding trade.
    - 3. To know the safety procedures and practices.
- **Second Year Goals:**
    - 1. To understand the proper care and maintenance of welding equipment and accessories.
    - 2. To obtain a basic knowledge of the correct practices and usages of equipment and accessories.
    - 3. To acquire knowledge of the techniques involved in arc and gas welding and oxygen cutting
- **Third Year & Up Goals:**
    - 1. To understand the proper care and maintenance of welding equipment and accessories.
    - 2. To be familiar with the terms and definitions of welding.
    - 3. To acquire knowledge of the techniques involved in arc and gas welding and oxygen cutting.

Project ideas:

At a minimum, projects should include one welded project. Youth could include a poster or notebook showing welding topics listed below.

- **Apprentice (1st and 2nd year)**
    - Project should showcase 3 different weld types.
    - show safety procedures and practices in welding (clothing, gloves, shoes, helmet, safety glasses, etc.)
    - Show the basic knowledge of welding (striking and arc, running a straight weld, setting heat range, learning electrodes & current flow, etc.)
    - Show measurement tools used in welding.
    - Show how to prepare joints
- **Handyman (3rd and 4th year)**
    - Project should showcase 1 new welding technique and should be harder than the previous years.
- **Craftsman (5th year and beyond)**
    - Project should showcase 1 new welding technique.
    - Youth could use some out-of-position welding, flame cutting and fitting for project.
    - Projects should have some degree of difficulty (cutting, grinding weld).
    - Blueprints and list of materials for the project should be made before starting.
    - What are the variety of ways that welding can be used (home vs. career).
    - Interview someone whose career uses welding, how often do they use it, what type of classes did they take, are there continuing education classes that can be taken?