

# Invention



**Definition:** An invention is a new device, contrivance, process, or an improvement on an existing machine or product that solves a real or perceived problem or need.

The Invention category is a general category intended to provide an opportunity for a student or group of students to present an innovative solution to a problem, or a new single item invention. The category allows for the student(s) to express themselves through illustrative design detail. The student(s) will transfer their understanding, communicate the invention's use and benefits, and construct a prototype design.

## Requirements:

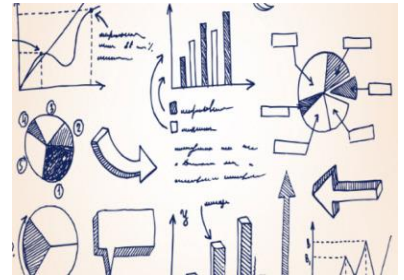
A successful Invention must have the following:

- Labeled illustration showing two points of view or perspectives of proposed invention
- A 'mock-up' or prototype construction that is complete enough to show the important aspects of the invention
- Display and documentation detailing materials needed; how invention would be used; how it would be beneficial; and description of intended audience / user of the invention

Additional judging will be based on the following:

- Sequential steps in the design process identified, including any problems encountered, and their solutions
- Research evidence provided that no similar process or product exists
- The invention uses unique or innovative methodologies in solving the problem or need
- Drawings or descriptive text clearly describes construction process
- Materials required to build the invention are described and specified
- Benefits of invention to target users and general public are clearly explained
- Target audience or users of the invention are identified and have a valid need for the invention
- Overall invention described clearly
- Visual aids promote understanding
- Prototype is well designed and constructed
- The invention is practical in terms of size, cost, materials, etc. for the problem being solved
- The invention offers functionality that solves the problem efficiently
- The invention addresses a real world problem or need
- Further steps beyond creation of the invention have been initiated or taken (e.g. patents, market research, public presentation, etc.)
- **\*\*All those entering this for competition will also need to give a 2-3 minute oral presentation for the judges and be able to answer any questions the judges may ask.**

# Science Poster/Infographic



**Definition:** An infographic (information graphic) is a representation of information in a graphic format designed to make the data easily understandable at a glance. People use infographics to quickly communicate a message, to simplify the presentation of large amounts of data, to see data patterns and relationships, and to monitor changes in variables over time.

The Science Poster/Infographic category is intended to provide a means of sharing about a scientific process, discovery, or concept in a visual way. The category allows for the student(s) to be challenged not only to have an accurate understanding of their information, but also to communicate it clearly and effectively through visuals.

## Requirements:

A successful Science Poster/Infographic entry must have the following:

- An accurate, clearly communicating, and aesthetically pleasing visual representation of a science process, discovery, or concept on a self-standing 22" x 28" poster board

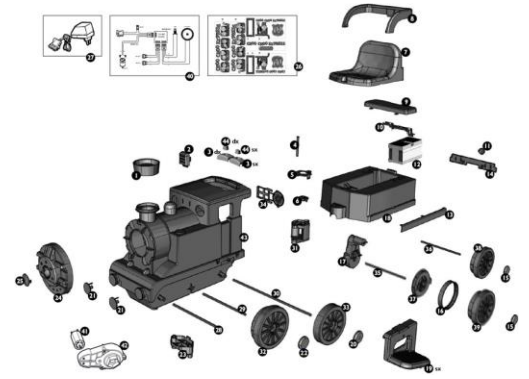
Additional judging will be based on the following:

- Knowledge and understanding of the topic is conveyed
  - Topic is clearly and succinctly communicated through words and graphics
  - Words and graphics elicit an emotional response
  - Thinking includes creative use of ideas and imagination
  - Words and graphics "tell a story" and lead its readers on a journey of understanding
  - Visual presentation is clean and well laid out
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- **\*\*All those entering this for competition will also need to give a 2-3 minute oral presentation for the judges and be able to answer any questions the judges may ask.**

# Reverse Engineering

**Definition:** Reverse engineering is the process of discovering the technological principles of a device, object, or system through analysis of its structure, function, and operation. It often involves taking something (e.g., a mechanical device or electronic component) apart and analyzing its workings in detail to be used in maintenance.

The Reverse Engineering category is intended to provide a means of discovery of engineering concepts and methods. The participant must take something apart and learn how it works, then explain it!



## Requirements:

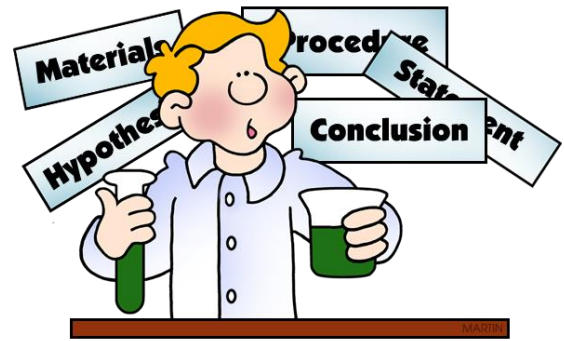
A successful Reverse Engineering entry must have the following:

- Locate and acquire two similar mechanical products (ie: toasters) of enough complexity that will allow a student to gain understanding of how it works in detail without being overwhelming
- Disassemble one product, then mount and label all components. Sub-components that are further disassembled may also be included
- Description paper explaining operation and functionality of all components - can include illustrations and/or images

Additional judging will be based on the following:

- Product is mechanical or electrical in nature, contains several major components, made from a variety of materials
- The overall unit and operation of the unit is explained
- Product has properly been disassembled to represent all components and all have been labeled
- Parts are described adequately and descriptions are accurate
- Function of each part is identified and correct
- Components are identified into sub-assembly groups by purpose (or location)
- Layout of parts alongside of the assembled unit is clear and promotes understanding of location and purpose
- Project is defined and organized
- Visual aids promote understanding
- Descriptive paper including the following: how the product works overall, steps for deconstruction, and any notes or logs written during the deconstruction.
- Each component is described adequately, material of composition is identified, and its function is explained
- Shows that the student grasps the purpose of the components and sub-assemblies, and how they work together
- The product is a real world item whose operation is not generally well understood
- \*\*All those entering this for competition will also need to give a 2-3 minute oral presentation for the judges and be able to answer any questions the judges may ask.

# Scientific Inquiry



**Definition:** Scientific Inquiry is the basic experimentation category where a question is asked, a hypothesis is created, an investigation is performed, and a conclusion is reached.

Scientific Inquiry is the basic experimentation category. The items pertaining to this category cover Scientific Methodology, Research, Hypothesis, Experiment Design, Data Collection and Analysis. Scientific Inquiry requires students to use higher order thinking skills as they learn science using a hands-on minds-on approach.

## Requirements:

A successful Scientific Inquiry entry must have the following:

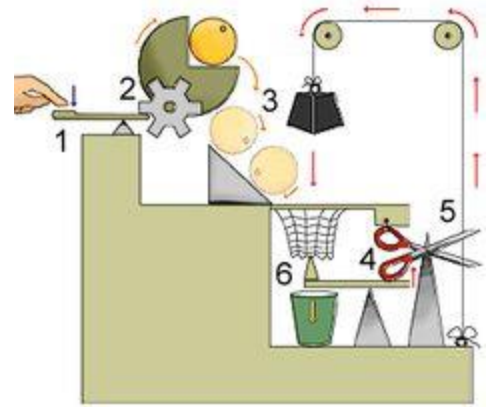
- Scientific method must be utilized
- Ask a testable question
- Research the topic
- Make a hypothesis about the outcome based on the research or their own knowledge
- Design the investigation
- Conduct the investigation
- Collect data
- Make sense of the data and draw a conclusion
- Present their findings for review:
  - Those who enter the category for competition will need to give a 2-3 minute oral presentation for the judges. They will also need to answer any questions the judges may ask about their project.
  - Those entering for display only should engage other students and/or adults to review their results and conclusions to receive constructive critique regarding their project.
- Tri-fold display must address all elements of scientific method, must include visuals
- Project display must be viewer friendly and safe

Additional judging is based on the following:

- The scientific method shows completeness of thought and cause and effect are clearly explained
- The display and descriptive document (optional) describe clearly identifies the controls and variables (dependent and independent) and how they are incorporated in your experiment
- The inquiry relates to broader scientific principles, real world applications
- The idea for investigation is original or innovative

# Rube Goldberg

**Definition:** A Rube Goldberg machine, contraption, invention, device, or apparatus is a deliberately over-engineered or overdone machine that performs a very simple task in a very complex fashion, usually including a chain reaction. The expression is named after American cartoonist and inventor Rube Goldberg (1883-1970).



## Requirements:

A successful Rube Goldberg entry must have the following:

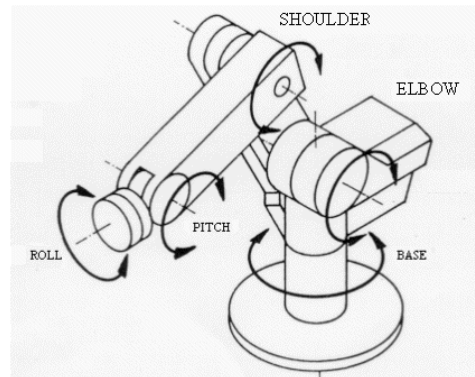
- A minimum of 10 'cause and effect' steps
- Inclusion of at least three different types of simple machines (e.g. lever, wheel and axle, pulley, incline plane, screw, wedge)
- A written procession of steps from beginning to end are alphabetically labelled
- The project entry stays within the maximum dimensions of Width = 36" Length = 30"

Additional judging will be based on the following:

- Device has a clearly identified task
- Initialization of sequence is simple and straightforward
- Use of several types of physical forces (inertia, gravity, friction, combustion, stored energy, etc.)  
Note: Any projects including combustion in their process must be approved by Mrs. Del Rosario and only run during the presentation day in the presence of Mrs. Del Rosario or an adult judge.
- Operational procession clearly labeled in alphabetic sequence
- Simple machines identified correctly with indications of direction of force and type of force
- Illustrations or collage (if used) clearly define operation of sequence
- Detail of illustrations or collage show different views of the steps in the sequence and of the timeline
- Device's construction has specific theme, or specific grouping of materials are used in constructions
- Device runs fully to completion with little or no outside intervention
- Complexity of device
- Thought was given to reset time and effort required
- Multiple paths of events occur and rejoin
- \*\*All those entering this for competition will also need to give a 2-3 minute oral presentation for the judges and be able to answer any questions the judges may ask.

# Robotics/Computer Programming

**Definition:** A robot is a mechanical agent that can perform tasks automatically. Similarly computer science is the design of software that can perform tasks. Computer software and robots both be operated automatically (autonomous), semi-autonomous, or remotely controlled. Both computers and robots are designed to be used for one or more specific purposes.



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## Requirements:

A successful Robotics and/or Computer Programming entry must have the following:

- Good physical design [may refer to mechanical functionality and/or UI (User Interface)]
- Operation is repeatable and consistent with the planned function
- The project display should show the following and may include a paper with more information:
  - A working robot or sub-assembly or, if software, the working software should be presented
  - The function or purpose of the robot or software should be described

Additional judging will be based on the following:

- Sensors and/or operator input is appropriate and understandable for the planned purpose(s)
- Manipulators and/or displays are used as needed to accomplish the needed tasks
- Physical or interface construction is appropriate and elegant
- Operational methods of the software or robot are complete and appropriate for the purpose
- Design allows for variables in the operating environment and error handling
- The project display should show the following and may include a paper with more information:
  - The description and clarification of any sub-components should be explained
  - A description of the methodology used to operate the robot or software may be included
- Considerations for alternative operation based on variations in operating parameters
- Documented code or design information
- Efficiency of design (software code and /or mechanical design)
- Entry relates to real-world applications
- Robot or software and/or the associated purpose is original or innovative

- Illustrations, images, or other media that is presented as supporting information
- \*\*All those entering this for competition will also need to give a 2-3 minute oral presentation for the judges and be able to answer any questions the judges may ask.