ST. CHARLES PARISH PUBLIC SCHOOLS

Middle School Science Project Handbook

Science Project Timeline

Science teachers will provide the due dates for each science project component.

Due Date	Science Project Component	Date completed
	Statement of Compliance – Last page of this handbook. Detach sheet. Must be completed by the student & his/her parent/guardian then returned to teacher.	
	Topic- must be approved by teacher before beginning experimentation	
	Research Plan with Student Checklist 1A and Approval Form 1B attached. Completed by the student following ISEF Research Plan Instructions**. M ust be approved by your teacher BEFORE beginning experimentation.**	
	Science Project Logbook –The student must document his/her research, data, and conclusions throughout the research and experimentation process.	
	School Science Fair Set-up	
	School Science Fair	

You and I ... We are
ST. CHARLES PARISH PUBLIC SCHOOLS

13855 River Road
Luling, LA 70070
985.785.6289
www.stcharles.k12.la.us

Dear Parents/Guardians,

Parental support is a key to a student's success in the development and completion of a Science Fair Project. **Please read the Science Fair Handbook with your child and sign the Statement of Compliance found on the last page of the Handbook. Return the Statement of Compliance to your child's science teacher so that the teacher will know that you reviewed this Middle School Science Fair Handbook with your child and understood the expectations for the completion of a Science Fair Project.**

As part of the middle school science curriculum, all students in grade 8 shall be required to complete a science fair project and participate in their school science fair. Students in grades 6 and 7 are encouraged to complete a science project and participate in their school science fair. The science project provides an opportunity for students to address life science, environmental science, earth science, or physical science concepts. No team projects are allowed at grade 8.

Completing a science project can be a valuable experience for your child. Studies show that the completion of the science project process can boost a child's thinking skills, build self-confidence, increase organizational levels, teach goal-setting, and develop responsibility. The real life experiences provided by a science project can also further develop reading, research, writing, speaking, creative thinking and problem-solving skills.

We ask that you encourage your child and monitor her or his progress as s/he works through the process to complete a science fair project by:

- Guiding your child through the project and allowing him/her to assume as much of the responsibility as possible.
- Reading and understanding the rules and regulations for completing a science project.
- Being supportive and encouraging to your child's efforts.
- Helping your child to meet deadlines and timetables in completing his/her science project.
- Providing transportation to the library, research site, and other places (i.e., bringing project to and from the school fair and also to and from the parish fair if eligible).
- Asking questions. (e.g., Can your child describe his/her science project?)
- Assisting your child in seeking additional help when needed.
- Helping your child obtain the materials needed for his/her project.
- Making sure that your child's experimental design and investigation are safe and do not cause any adverse effects for humans, vertebrates or the environment.

If you have any questions, please do not hesitate to contact your child's science teacher.

Sincerely,

RSA Felecia Gomez-Walker
Felecia Gomez-Walker
Superintendent

You and I ... We are
ST. CHARLES PARISH PUBLIC SCHOOLS

13855 River Road
Luling, LA 70070
985.785.6289
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Dear Science Student,

Please read the Science Fair Handbook with your parent/guardian and sign the Statement of Compliance found on the last page of the Handbook. Return the Statement of Compliance to your science teacher so that s/he will know that you and your parent reviewed this Science Fair Handbook and understood the expectations for the completion of a Science Fair Project.

Completing a science project will give you an opportunity to think and work like a scientist. Just like a scientist, you will choose your own scientific question to answer, conduct research to find out what other scientists have learned about your question, form a hypothesis, and design an experiment to test your hypothesis. In the process of completing your project, you will gather and organize data, analyze the data, and make a conclusion. You will collaborate and discuss your experiment and findings with others. You will use skills you have learned from Social Studies, English, Math, Technology, the Arts, the Sciences, and everyday life to help you complete your project.

To think and work like a scientist to complete your science project, you will be expected to:

- Pick a topic that you are interested in and can be answered by doing a test, survey or experiment yet in no way causes danger or harm to any human, vertebrate, or the environment..
- Design and complete a science project that uses the scientific method (do research, identify a problem, state a hypothesis, conduct an experiment and reach a conclusion) to answer a testable scientific question and is a reflection of your own effort and learning.
- Actively participate in all science classroom activities and instruction.
- Read and understand the rules and regulations for completing a science project.
- Meet all safety guidelines.
- Maintain a log book to document your work throughout the science project process.
- Meet deadlines to complete and turn in tasks (e.g., research plan, forms) set by your science teacher.
- Participate in the school science fair by displaying work and presenting orally your findings to judges.

Your teacher and your parents will help guide you as you work on your project, but this is your chance to be in charge of your own learning and to think and work like a scientist! Enjoy the journey!

Sincerely,

RGA Felecia Gomez-Walker
Felecia Gomez-Walker
Superintendent

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Science Fair Project Purpose & Goals

Why should I do a Science Fair Project?

The science fair project provides an opportunity for students to address life science, environmental science, physical science, or earth science concepts. Through the development of science fair projects, students gain knowledge and skills that contribute to the achievement of three *St. Charles Parish Learner Goals*:

A KNOWLEDGEABLE, COMPETENT PERSON

- Accesses, analyzes, and processes information
- Acquires new knowledge and skills and applies the learning to various situations
- Understands the interrelationships among concepts, principles, and skills
- Uses technology to gather, analyze, and synthesize information

A CRITICAL THINKER

- Identifies, assesses, integrates, and utilizes information and resources to solve problems and make decisions
- Demonstrates the ability to ask questions in order to continuously improve products, services, or processes
- Demonstrates adaptability, flexibility, and the ability to use a variety of tools to solve problems

AN EFFECTIVE COMMUNICATOR

- Uses verbal, written, and presentation skills effectively
- Demonstrates ability to develop and deliver clear, concise key messages
- Develops visual representations that communicate key points

Student achievement on science fair projects will be used to measure progress towards these goals.

Science Research & the Process of Science

Research is a process by which people discover or create new knowledge about the world in which they live.

Research projects are designed to provide quantitative data through experimentation followed by analysis and application of that data. Projects that are demonstrations, 'library' research, or informational projects, 'explanation' models or kit building are not appropriate for research based science fairs.

Question: Ask a testable question – one in which data is taken and used to find the answer or define a problem. A testable question can further be defined as one in which one or more variables can be identified and tested to see the impact of that variable on the original set of conditions. The question should not merely be an 'information' question where the answer is obtainable through literature research.

Background Research: Review published materials related to your problem or question. This is called background research.

Hypothesis: Evaluate possible solutions and write a hypothesis for what you think will happen.

Experimental Design (procedure): In designing the experiment, it is critical that only one variable – a condition that may affect the results of the experiment – is changed at a time. This makes the experiment a 'controlled' experiment.

Data Collection and Analysis: Challenge and test your hypothesis through your procedure of experimentation (data collection) and analysis of your data. Use graphs to help see patterns in the data.

Conclusions: Draw conclusions based on empirical evidence from the experiment.

Non Inquiry Based Research

Not all areas of study are best served by scientific method based research. Engineers, inventors, mathematicians, theoretical physicists, and computer programmers have different objectives than those of other scientists; they follow a different process in their work. The process that they use to answer a question or solve a problem is different depending on their area of study.

Engineering projects may include the following:

1) Define a need or "How can I make this better?"
2) Develop or establish design criteria (could be more than one)
3) Do background research and search the literature to see what has already been done or what products already exist that fill a similar need? What makes them good and what makes them weak?
4) Prepare preliminary designs and a materials list. Consider costs, manufacturing, and user requirements.
5) Build and test a prototype of your best design. Consider reliability, repair, and servicing.
6) Retest and redesign as necessary.
7) Present results.

Computer Science Projects -These often involve creating and writing new algorithms to solve a problem or improve on an existing algorithm. Simulations, models, or 'virtual reality' are other areas on which to conduct research.

Mathematics Projects-These involve proofs, solving equations, etc. Math is the language of science and is used to explain existing phenomena or prove new concepts and ideas.

Theoretical Projects -These projects may involve a thought experiment, development of new theories and explanations, concept formation, or designing a mathematical model.

Assessment

How will my science project be graded?

The science fair project will be used for a summative science grade for 8th grade students. The summative grade will be based on the following components:

- originality and uniqueness,
- scientific thought or engineering goals,
- thoroughness,
- skill, and
- project presentation.

Formative grades will be assigned by the teacher throughout the process.

Teachers will use the points a student earned on the school science fair judging sheet to assign a score for the project presentation component to the student's science summative grade.

The following scale will be used:

52-64 points = 4 Exceeds Expectations
40-51 points = 3 Meets Expectations
28-39 points = 2 Partially Meets Expectations
16-27 points = 1 Does Not Meet Expectations
0 points = 0 No Attempt (*If a student does not participate in the school science fair, he/she will receive 0 points)*

Science fair judges will use the School/Parish Science Fair Judging Sheet to determine 1st, 2nd, and 3rd place winners for each of the science fair categories at the school and parish science fairs.

While students in grades 6-7 will not receive a grade or bonus points for participating in the school science fair, they will have the same opportunities as the 8th grade students to advance to the next levels of competition.

What is my teacher looking for?

Student Name: _____ Class_____

St. Charles Parish Public Schools

Science Project Scoring Rubric for Teacher Use

This rubric is designed for multiple checks throughout the science project process. Teachers are provided the opportunity to date, score, and provide feedback to students to ensure students are meeting the project expectations. Note: A zero may be used if a student does not complete a component or present his/her project at the school fair.

Date	Component	4	3	2	1	0	Total	Comments
	Identifying Questions and Formulating Hypotheses that May be Examined through Scientific Investigations Formulates testable questions and hypotheses that are specific, based on scientific concepts, and lead to scientific investigations						X3	
	Designing and Conducting a Scientific Investigation Identifies what variable is controlled and what variables are manipulated; design of investigation is sequential and logical to the hypothesis; experimental design requires minimal teacher guidance						X4	
	Using Appropriate Tools and Techniques to Collect and Record Data Collects and records data which is complete, accurate, and objective; collects and records data using graphs, charts, and tables; uses SI units(metric system) to express measurements; uses appropriate equipment and techniques; requires minimal teacher guidance						X3	
	Using Evidence to Develop Explanations and Describe Relationships between Evidence and Explanation Data is analyzed objectively; student draws logical inferences based on observed patterns and relationships; inferences lead to questions for future investigations						X3	
	Project Presentation The following key should be used after students have presented their projects at the school level and scored by the science fair judges. Judges' Scores Exemplary 52-64 points =4 Proficient 40-51 points = 3 Progressing 28-39 points =2 Beginning 16-27 points = 1 No Attempt 0 points = 0						X1	
	Total points **56 points max.**							
	Science Fair Project Grade **100 points max.** The total rubric score is converted to a summative grade using the *Science Fair Project Grade Conversion Chart.*							

What are the judges looking for?

ST. CHARLES PARISH PUBLIC SCHOOLS SCIENCE FAIR JUDGING SHEET

Elementary Division: Grades 4-5 **Category (Circle One)** Biological Chemical Earth/Environmental Physical

Junior Division: Grades 6-8 **Senior Division: Grades 9-12**

Circle One Category

Animal Sciences	Behavioral/Social	Biochemistry	Biomedical & Health	Cellular/Molecular
Chemistry	Computational Biology & Bioinformatics	Earth & Environmental	Embedded Systems	Energy: Chemical
Energy: Physical	Engineering Mechanics	Environmental Engineering	Materials Science	Mathematics
Physics/Astronomy	Plant Sciences	Robotics & Intelligent Machines	Systems Software	

Project Number/Title: _____

	4	3	2	1		Total Points
Originality and Uniqueness (Learner Goal: A Creative Producer)					**X 3**	
• **Problem is meaningful to the student and well researched.** • **Problem is conceptually intricate/requires extra effort and involves a creative approach.** • **Hypothesis is clearly stated and explained.**						
Scientific Thought and Engineering Goals (Learner Goal: A Critical Thinker)					**X 4**	
• **The student generates a testable question about objects, organisms, or events that can be answered through a scientific investigation.** • **The steps of the procedure are listed, sequential and detailed.** • **All materials are listed. Variables have been identified. Controls are appropriate, in place, and explained.**						
Thoroughness (Learner Goal: A Knowledgeable, Competent Person)					**X 3**	
• **The student displays a high level of subject knowledge from research and the process of completing the experiment.** • **The student can thoroughly explain the process, procedures, and conclusions of his/her project.**						
Skill (Learner Goal: A Knowledgeable, Competent Person)					**X 3**	
• **The proper use of SI units (Metric System) is utilized.** • **There are an adequate number of trials/sample sizes.** • **There is an appropriate use of photos/charts/graphs/tables to display data.**						
Clarity (Learner Goal: An Effective Communicator)					**X 1**	
• **The display is neat, attractive, and creative.** • **Spelling and grammar are correct.** • **Graphs and charts are properly labeled.**						
Effective Communicator (Learner Goal: An Effective Communicator)					**X 2**	
• **The student uses verbal, written, and presentation skills effectively (e.g., enthusiasm, posture, speaks clearly, eye contact).** • **The student demonstrates ability to develop and deliver clear, concise key messages (e.g., preparedness, content) and is able to speak for 2-3 minutes on topic.** • **The student responds to judges' questions directly and accurately (2-3 minutes).**						
Total Possible Points = 64						

Comments: _____

_____

Scoring:
4 = Exceeds requirements
3 = Meets requirements
2 = Partially meets requirements
1 = Does not meet requirements

CHOOSING A SCIENCE FAIR TOPIC

How do I choose a science Fair Project topic?

Finding ideas for a science project and determining exactly what topic you choose can be challenging and takes some time and thought.

Consider choosing a topic that interests you. For example,

- a hobby that might give you something to investigate,
- an interest in a sport may provide ideas for investigations,
- a science –related magazine or newspaper article may spark your interest and provide the opportunity for experimentation, and
- websites which offer suggestions for science projects or pique your interest and provide possibilities for experimentation.

Determine if the project is feasible. Ask yourself,

- Does the project ask a testable question?
- Can I complete the project in the amount of time allowed? Do I have enough time to test and retest and redesign if needed?
- Does this project cause any environmental concerns?
- Do I have adequate resources (equipment, materials, special equipment such as microscopes, budget, etc.) to carry out the investigation?
- Is the design of the experiment adequate? Can I measure the effects using quantitative and qualitative data?
- Is the plan for experimentation safe?
- Does the project conform to ISEF and St. Charles Parish Public Schools Science Fair Rules and Regulations?
- Does my project involve human subjects, vertebrate animals, potentially hazardous biological agents, or hazardous chemical, activities, or devices that require approval and the completion of specific forms that need approval by a SRC/IRB before I can start experimentation?

https://member.societyforscience.org/document.doc?id=639

Read through the Intel ISEF Categories and Subcategories and their descriptions.

https://student.societyforscience.org/intel-isef-categories-and-subcategories

ANIMAL SCIENCES (Code: ANIM) This category includes all aspects of animals and animal life, animal life cycles, and animal interactions with one another or with their environment. Examples of investigations included in this category would involve the study of the structure, physiology, development, and classification of animals, animal ecology, animal husbandry, entomology, ichthyology, ornithology, and herpetology, as well as the study of animals at the cellular and molecular level which would include cytology, histology, and cellular physiology.

Animal Behavior: The study of animal activities which includes investigating animal interactions within and between species or an animal's response to environmental factors. Examples are animal communication, learning, and intelligence, rhythmic functions, sensory preferences, pheromones, and environmental effects on behaviors, both naturally and experimentally induced.

Cellular Studies: The study of animal cells involving the use of microscopy to study cell structure and studies investigating activity within cells such as enzyme pathways, cellular biochemistry, and synthesis pathways for DNA, RNA, and protein.

Development: The study of an organism from the time of fertilization through birth or hatching and into later life. This includes cellular and molecular aspects of fertilization, development, regeneration, and environmental effects on development.

Ecology: The study of interactions and behavioral relationships among animals, and animals and plants, with their environment and with one another.

Genetics: The study of species and population genetics at the organismal or cellular level.

Nutrition and Growth: The study of natural, artificial, or maternal nutrients on animal growth, development, and reproduction including the use and effects of biological and chemical control agents to control reproduction and population numbers.

Physiology: The study of one of the 11 animal systems. This includes structural and functional studies, system mechanics, and the effect of environmental factors or natural variations on the structure or function of a system. Similar studies conducted specifically at the cellular level should select the cellular studies subcategory.

Systematics and Evolution: The study of animal classification and phylogenetic methods including the evolutionary relationships between species and populations. This includes morphological, biochemical, genetic, and modeled systems to describe the relationship of animals to one another.

BEHAVIORAL AND SOCIAL SCIENCES (Code: BEHA) The science or study of the thought processes and behavior of humans and other animals in their interactions with the environment studied through observational and experimental methods.

Clinical and Developmental Psychology: The study and treatment of emotional or behavioral disorders. Developmental psychology is concerned with the study of progressive behavioral changes in an individual from birth until death.

Cognitive Psychology: The study of cognition, the mental processes that underlie behavior, including thinking, deciding, reasoning, and to some extent motivation and emotion. Neuro-psychology studies the relationship between the nervous system, especially the brain, and cerebral or mental functions such as language, memory, and perception.

Physiological Psychology: The study of the biological and physiological basis of behavior.

Sociology and Social Psychology: The study of human social behavior, especially the study of the origins, organization, institutions, and development of human society. Sociology is concerned with all group activities-economic, social, political, and religious.

BIOCHEMISTRY (Code: BCHM) The study of the chemical basis of processes occurring in living organisms, including the processes by which these substances enter into, or are formed in, the organisms and react with each other and the environment.

Analytical Biochemistry: The study of the separation, identification, and quantification of chemical components relevant to living organisms.

General Biochemistry: The study of chemical processes, including interactions and reactions, relevant to living organisms.

Medicinal Biochemistry: The study of biochemical processes within the human body, with special reference to health and disease.

Structural Biochemistry: The study of the structure and or function of biological molecules.

BIOMEDICAL AND HEALTH SCIENCES (Code: BMED) This category focuses on studies specifically designed to address issues of human health and disease. It includes studies on the diagnosis, treatment, prevention or epidemiology of disease and other damage to the human body or mental systems. Includes studies of normal functioning and may investigate internal as well as external factors such as feedback mechanisms, stress or environmental impact on human health and disease.

Disease Diagnosis: The systematic examination, identification, and determination of disorders and disease through examination at the whole body or cellular levels.

Disease Treatment: The use of pharmaceuticals and other therapies, including natural and holistic remedies, intended to improve symptoms and treat or cure disorders or disease.

Drug Development and Testing: The study and testing of new chemical therapies intended to improve symptoms and treat or cure disorders and disease. This testing could include any platform from tissue culture to preclinical animal models. This will include establishing a drug's safety profile and ensuring regulatory compliance.

Epidemiology: The study of disease frequency and distribution, and risk factors and socioeconomic determinants of health within populations. Epidemiologic investigations may include gathering information to confirm existence of disease outbreaks, developing case definitions and analyzing epidemic data, establishing disease surveillance, and implementing methods of disease prevention and control.

Nutrition: The study of food, nutrients and dietary need in humans, and the effects of food and nourishment on the body. These studies may include the effects of natural or supplemental nutrients and nutrition.

Physiology and Pathology: The science of the mechanical, physical, and biochemical functions of normal human tissues, organs, and body systems; and the study of disease-related tissue and organ dysfunction. Pathophysiology is the study of the conditions leading up to a diseased state and includes an investigation of the disturbance responsible for causing the disease.

CELLULAR AND MOLECULAR BIOLOGY (Code: CELL) This is an interdisciplinary field that studies the structure, function, intracellular pathways, and formation of cells. Studies involve understanding life and cellular processes specifically at the molecular level.

Cell Physiology: The study of the cell cycle, cell function, and interactions between cells or between cells and their environment.

Genetics: The study of molecular genetics focusing on the structure and function of genes at a molecular level.

Immunology: The study of the structure and function of the immune system at the cellular level. This includes investigations of innate and acquired (adaptive) immunity, the cellular communication pathways involved in immunity, cellular recognition, graft vs host and host vs graft disease, and interactions between antigens and antibodies.

Molecular Biology: The study of biology at the molecular level. Chiefly concerns itself with understanding the interactions between the various systems of a cell, including the interrelationships of DNA, RNA and protein synthesis and learning how these interactions are regulated, such as during transcription and translation, the significance of introns and exons or coding issues.

Neurobiology: The study of the structure and function of the nervous system at the cellular or molecular level.

CHEMISTRY (Code: CHEM) Studies exploring the science of the composition, structure, properties, and reactions of matter not involving biochemical systems.

Analytical Chemistry: The study of the separation, identification, and quantification of the chemical components of materials.

Computational Chemistry: A study that applies the discipline and techniques of computer science and mathematics to solve large and complex problems in Chemistry.

Environmental Chemistry: The study of chemical species in the natural environment, including the effects of human activities, such as the design of products and processes that reduce or eliminate the use or generation of hazardous substances.

Inorganic Chemistry: The study of the properties and reactions of inorganic and organometallic compounds.

Materials Chemistry: The chemical study of the design, synthesis and properties of substances, including condensed phases (solids, liquids, polymers) and interfaces, with a useful or potentially useful function, such as catalysis or solar energy.

ORG Organic Chemistry: The study of carbon-containing compounds, including hydrocarbons and their derivatives.

Physical Chemistry: The study of the fundamental physical basis of chemical systems and processes, including chemical kinetics, chemical thermodynamics, electrochemistry, photochemistry, spectroscopy, statistical mechanics and astro-chemistry.

COMPUTATIONAL BIOLOGY AND BIOINFORMATICS (Code: CBIO) Studies that primarily focus on the discipline and techniques of computer science and mathematics as they relate to biological systems. This includes the

development and application of data-analytical and theoretical methods, mathematical modeling and computational simulation techniques to the study of biological, behavior, and social systems.

Biomedical Engineering: The application of engineering principles and design concepts to medicine and biology for healthcare purposes.

Computational Biomodeling: Studies that involve computer simulations of biological systems most commonly with a goal of understanding how cells or organism develop, work collectively and survive.

Computational Evolutionary Biology: A study that applies the discipline and techniques of computer science and mathematics to explore the processes of change in populations of organisms, especially taxonomy, paleontology, ethology, population genetics and ecology.

Computational Neuroscience: A study that applies the discipline and techniques of computer science and mathematics to understand brain function in terms of the information processing properties of the structures that make up the nervous system.

Computational Pharmacology: A study that applies the discipline and techniques of computer science and mathematics to predict and analyze the responses to drugs.

Genomics: The study of the function and structure of genomes using recombinant DNA, sequencing, and bioinformatics.

EARTH AND ENVIRONMENTAL SCIENCES (Code: EAEV) Studies of the environment and its effect on organisms/systems, including investigations of biological processes such as growth and life span, as well as studies of Earth systems and their evolution.

Atmospheric Science: Studies of the earth's atmosphere, including air quality and pollution and the processes and effects of the atmosphere on other Earth systems as well as meteorological investigations.

Climate Science: Studies of Earth's climate, particularly evidential study of climate change.

Environmental Effects on Ecosystems: Studies of the impact of environmental changes (natural or as a result of human interaction) on ecosystems, including empirical pollution studies.

Geosciences: Studies of Earth's land processes, including mineralogy, plate tectonics, volcanism, and sedimentology.

Water Science: Studies of Earth's water systems, including water resources, movement, distribution, and water quality.

EMBEDDED SYSTEMS (Code: EBED) Studies involving electrical systems in which information is conveyed via signals and waveforms for purposes of enhancing communications, control and/or sensing.

Circuits: The study, analysis, and design of electronic circuits and their components, including testing.

Internet of Things: The study of the interconnection of unique computing devices with the existing infrastructure of the Internet and the cloud.

Microcontrollers: The study and engineering of microcontrollers and their use to control other devices.

Networking and Data Communication: The study of systems that transmit any combination of voice, video, and/or data among users.

Optics: The use of visible or infrared light instead of signals sent over wires. The study and development of optical devices and systems devoted to practical applications such as computation.

Sensors: The study and design of devices that transmit an electrical response to an external device.

Signal Processing: The extraction of signals from noise and their conversion into a representation for modeling and analysis.

ENERGY: CHEMICAL (Code: EGCH) Studies involving biological and chemical processes of renewable energy sources, clean transport, and alternative fuels.

Alternative Fuels: Any method of powering an engine that does not involve petroleum (oil). Some alternative fuels are electricity, methane, hydrogen, natural gas, and wood.
Computational Energy Science: A study that applies the discipline and techniques of computer science and mathematics to solve large and complex problems in Energy Science.

Fossil Fuel Energy: Studies involving energy from a hydrocarbon deposit, such as petroleum, coal, or natural gas, derived from living matter of a previous geologic time and used for fuel.

Fuel Cells and Battery Development: The study, analysis and development of fuel cells and batteries that convert and/or store chemical energy into electricity.

Microbial Fuel Cells: The study of fuel cells that use or mimic bacterial interactions found in nature to produce electricity.

Solar Materials: The study of materials used to convert and store solar energy through chemical changes. This includes topics such as thermal storage and photovoltaic materials.

ENERGY: PHYSICAL (Code: EGPH) Studies of renewable energy structures/processes including energy production and efficiency.

Hydro Power: The application of engineering principles and design concepts to capture energy from falling and running water to be converted to another form of energy.

Nuclear Power: The application of engineering principles and design concepts to capture nuclear energy to be converted to another form of energy.

Solar: The application of engineering principles and design concepts to capture energy from the sun to be converted to another form of energy.

Sustainable Design: The application of engineering principles and design concepts to plan and/or construct buildings and infrastructure that minimize environmental impact.

Thermal Power: The application of engineering principles and design concepts to capture energy from the Earth's crust to be converted to another form of energy.

Wind: The application of engineering principles and design concepts to capture energy from the wind to be converted to another form of energy.

ENGINEERING MECHANICS (Code: ENMC)

Studies that focus on the science and engineering that involve movement or structure. The movement can be by the apparatus or the movement can affect the apparatus.

Aerospace and Aeronautical Engineering: Studies involving the design of aircraft and space vehicles and the direction of the technical phases of their manufacture and operation.

Civil Engineering: Studies that involve the planning, designing, construction, and maintenance of structures and public works, such as bridges or dams, roads, water supply, sewer, flood control and, traffic.

Computational Mechanics: A study that applies the discipline and techniques of computer science and mathematics to solve large and complex problems in Engineering Mechanics.

Control Theory: The study of dynamical systems, including controllers, systems, and sensors that are influenced by inputs.

Ground Vehicle Systems: The design of ground vehicles and the direction of the technical phases of their manufacture and operation.

Industrial Engineering-Processing: Studies of efficient production of industrial goods as affected by elements such as plant and procedural design, the management of materials and energy, and the integration of workers within the overall system. The industrial engineer designs methods, not machinery.

Mechanical Engineering: Studies that involve the generation and application of heat and mechanical power and the design, production, and use of machines and tools.

Naval Systems: Studies of the design of ships and the direction of the technical phases of their manufacture and operation.

ENVIRONMENTAL ENGINEERING (Code: ENEV)

Studies that engineer or develop processes and infrastructure to solve environmental problems in the supply of water, the disposal of waste, or the control of pollution.

Bioremediation: The use of biological agents, such as bacteria or plants, to remove or neutralize contaminants. This includes phytoremediation, constructed wetlands for wastewater treatment, biodegradation, etc.

Land Reclamation: The application of engineering principles and design techniques to restore land to a more productive use or its previous undisturbed state.

Pollution Control: The application of engineering principles and design techniques to remove pollution from air, soil, and/or water.

Recycling and Waste Management: The extraction and reuse of useful substances from discarded items, garbage, or waste. The process of managing, and disposing of, wastes and hazardous substances through methodologies such as landfills, sewage treatment, composting, waste reduction, etc.

Water Resources Management: The application of engineering principles and design techniques to improve the distribution and management of water resources.

MATERIALS SCIENCE (Code: MATS) The study of the characteristics and uses of various materials with improvements to their design which may add to their advanced engineering performance.

Biomaterials: Studies involving any matter, surface, or construct that interacts with biological systems. Such materials are often used and/or adapted for a medical application, and thus comprise whole or part of a living structure or biomedical device which performs, augments, or replaces a natural function.

Ceramic and Glasses: Studies involving materials composed of ceramic and glass – often defined as all solid materials except metals and their alloys that are made by the high-temperature processing of inorganic raw materials.

Composite Materials: Studies involving materials composed of two or more different materials combined together to create a superior and unique material.

COM Computation and Theory: Studies that involve the theory and modeling of materials.

Electronic, Optical and Magnetic Materials: The study and development of materials used to form highly complex systems, such as integrated electronic circuits, optoelectronic devices, and magnetic and optical mass storage media. The various materials, with precisely controlled properties, perform numerous functions, including the acquisition, processing, transmission, storage, and display of information.

Nanomaterials: The study and development of nanoscale materials; materials with structural features (particle size or grain size, for example) of at least one dimension in the range 1-100 nm.

Polymers: The study and development of polymers; materials that have a molecular structure consisting chiefly or entirely of a large number of similar units bonded together, e.g., many synthetic organic materials used as plastics and resins.

MATHEMATICS (Code: MATH) The study of the measurement, properties, and relationships of quantities and sets, using numbers and symbols. The deductive study of numbers, geometry, and various abstract constructs, or structures.

Algebra: The study of algebraic operations and/or relations and the structures which arise from them. An example is given by (systems of) equations which involve polynomial functions of one or more variables.

Analysis: The study of infinitesimal processes in mathematics, typically involving the concept of a limit. This begins with differential and integral calculus, for functions of one or several variables, and includes differential equations.

Combinatorics, Graph Theory and Game Theory: The study of combinatorial structures in mathematics, such as finite sets, graphs, and games, often with a view toward classification and/or enumeration.

Geometry and Topology: The study of the shape, size, and other properties of figures and spaces. Includes such subjects as Euclidean geometry, non-Euclidean geometries (spherical, hyperbolic, Riemannian, Lorentzian), and knot theory (classification of knots in 3-space).

Number Theory: The study of the arithmetic properties of integers and related topics such as cryptography.

Probability and Statistics: Mathematical study of random phenomena and the study of statistical tools used to analyze and interpret data.

MICROBIOLOGY (Code: MCRO) The study of micro-organisms, including bacteria, viruses, fungi, prokaryotes, and simple eukaryotes as well as antimicrobial and antibiotic substances.

Antimicrobials and Antibiotics: The study of a substance that kills or inhibits the growth of a microorganisms.

Applied Microbiology: The study of microorganisms having potential applications in human, animal or plant health or the use of microorganisms in the production of energy.

Bacteriology: The study of bacteria and bacterial diseases and the microorganisms responsible for causing a disease.

Environmental Microbiology: The study of the structure, function, diversity and relationship of microorganisms with respect to their environment. This includes the study of biofilms.

Microbial Genetics: The study of how microbial genes are organized and regulated and their involvement in cellular function.

Virology: The study of viruses and viral diseases.

PHYSICS AND ASTRONOMY (Code: PHYS) Physics is the science of matter and energy and of interactions between the two. Astronomy is the study of anything in the universe beyond the Earth.

Atomic, Molecular, and Optical Physics: The study of atoms, simple molecules, electrons and light, and their interactions.

Astronomy and Cosmology: The study of space, the universe as a whole, including its origins and evolution, the physical properties of objects in space and computational astronomy.

Biological Physics: The study of the physics of biological processes.
Computational Physics: A study that applies the discipline and techniques of computer science and mathematics to solve large and complex problems in Physics and Astrophysics.

Condensed Matter and Materials: The study of the properties of solids and liquids. Topics such as superconductivity, semi-conductors, complex fluids, and thin films are studied.

Instrumentation: Instrumentation is the process of developing means of precise measurement of various variables such as flow and pressure while maintaining control of the variables at desired levels of safety and economy.

Magnetics, Electromagnetics and Plasmas: The study of electrical and magnetic fields and of matter in the plasma phase and their effects on materials in the solid, liquid or gaseous states.

Mechanics: Classical physics and mechanics, including the macroscopic study of forces, vibrations and flows; on solid, liquid and gaseous materials.

Nuclear and Particle Physics: The study of the physical properties of the atomic nucleus and of fundamental particles and the forces of their interaction.

Optics, Lasers, Masers: The study of the physical properties of light, lasers and masers.

Quantum Computation: The study of the laws of quantum mechanics to process information. This includes studies involving the physics of information processing, quantum logic, quantum algorithms, quantum error correction, and quantum communication.

Theoretical Physics (THE): The study of nature, phenomena and the laws of physics employing mathematical models and abstractions rather than experimental processes.

PLANT SCIENCES (Code: PLNT)

Studies of plants and how they live, including structure, physiology, development, and classification. Includes plant cultivation, development, ecology, genetics and plant breeding, pathology, physiology, systematics and evolution.

Agronomy: Application of the various soil and plant sciences to soil management and agricultural and horticultural crop production. Includes biological and chemical controls of pests, hydroponics, fertilizers and supplements.

Growth and Development: The study of a plant from earliest stages through germination and into later life. This includes cellular and molecular aspects of development and environmental effects, natural or manmade, on development and growth.

Ecology: The study of interactions and relationships among plants, and plants and animals, with their environment.

Genetics/Breeding: The study of organismic and population genetics of plants. The application of plant genetics and biotechnology to crop improvement. This includes genetically modified crops.

Pathology: The study of plant disease states, and their causes, processes, and consequences. This includes effects of parasites or disease-causing microbes.

Physiology: The study of functions in plants and plant cells. This includes cellular mechanisms such as photosynthesis and transpiration, and how plant processes are affected by environmental factors or natural variations.

Systematics and Evolution: The study of classification of organisms and their evolutionary relationships. This includes morphological, biochemical, genetic, and modeled systems.

ROBOTICS AND INTELLIGENT MACHINES (Code: ROBO)

Studies in which the use of machine intelligence is paramount to reducing the reliance on human intervention.

Biomechanics: Studies and apparatus which mimic the role of mechanics in biological systems.

Cognitive Systems: Studies/apparatus that operate similarly to the ways humans think and process information. Systems that provide for increased interaction of people and machines to more naturally extend and magnify human expertise, activity, and cognition.

Control Theory: Studies that explore the behavior of dynamical systems with inputs, and how their behavior is modified by feedback. This includes new theoretical results and the applications of new and established control methods, system modelling, identification and simulation, the analysis and design of control systems (including computer-aided design), and practical implementation.

Robot Kinematics: The study of movement in robotic systems.

Machine Learning: Construction and/or study of algorithms that can learn from data.

SYSTEMS SOFTWARE (Code: SOFT) The study or development of software, information processes or methodologies to demonstrate, analyze, or control a process/solution.

Algorithms: The study or creation of algorithms - step-by-step procedure of calculations to complete a specific task in data processing, automated reasoning and computing.

Cybersecurity: Studies involving the protection of a computer or computer system against unauthorized access or attacks. This can include studies involving hardware, network, software, host or multimedia security.

Databases: Studies that create or analyze data organization for ease of access, management and update.

Operating Systems: The study of system software responsible for the direct control and management of hardware and basic system operations of a computer or mobile device.

Programming Languages: Studies that involve the development or analysis of the artificial languages used to write instructions that can be translated into machine language and then executed by a computer.

Websites to help you choose a topic

There are a myriad of websites available that can assist you in choosing a topic for your science fair project. A few websites are:

http://www.sciencebuddies.org/science-fair-projects/recommender_register.php

http://www.ipl.org/div/projectguide/choosingatopic.html

http://www.sciencemadesimple.com/science_fair_topic.html

https://slvsef.org/documents/teachers/SLVSEF_how_to_select_a_project.pdf

http://school.discoveryeducation.com/sciencefaircentral/Science-Fair-Projects/Choose-a-Science-Fair-Project-Idea.html

https://student.societyforscience.org/science-project-resources

Rules & Regulations

What rules and regulations must I follow for my project?

You need to be familiar with the rules and regulations for science projects before you decide on your topic.

These rules & regulations were developed to facilitate the following

- protect the rights and welfare of the student researcher and human subjects
- protect the health and well-being of vertebrate and animal subjects
- follow federal regulations governing research
- offer guidance to affiliated fairs
- ensure use of safe laboratory practices
- address environmental concerns

Before experimentation begins,

1. you need to become familiar with the rules and regulations established by the International Science and Engineering Fair (ISEF). Science fairs at the school level, parish level, region level, and state level all follow the ISEF rules and regulations.

   The ISEF Rules which may be accessed at

   https://member.societyforscience.org/document.doc?id=639

2. your topic must be approved by your teacher before proceeding with the required Research Plan.

3. you must submit a completed Research Plan following the provided guidelines with a completed Student Checklist (1A)**and Approval Form (1B)** for approval by your teacher.

   ****It is preferable that forms are typed. Interactive forms may be found at**

   https://student.societyforscience.org/forms

4. you also need to keep in mind that safety is of the utmost importance. Therefore, study the *SCIENCE FAIR DISPLAY AND SAFETY GUIDELINES CHECKLIST* included in this handbook.

At the school science fair, your display must include:

- a display board
- a copy of your research plan
- your log book
- your abstract
- a completed and signed S*cience Fair Display and Safety Guidelines Checklist* attached to the back right flap of the display board
- a completed *Science Fair Display Board Labe*l attached to the top of the back of the left flap of the display board

What if I want to do an investigation involving Humans, Vertebrates, Potentially Hazardous Biological Agents, Hazardous Chemicals or Devices?

if you are interested in experimenting with **humans, vertebrate animals, potentially biological hazardous** agents, or **hazardous chemicals, activities or devices**, review the rules for these projects on pages 8-19 in the *Intel International Science and Engineering Fair International Rules and Guidelines 2016*. It is unacceptable to hurt, scare, or jeopardize the health of people or animals. You cannot use dangerous materials that could potentially harm you, other people, or the environment.

Projects involving humans, vertebrate animals, potentially biological hazardous agents, or hazardous chemicals, activities or devices are likely to require further review by a science review committee consisting of educators and scientists in order to determine the risks of the project as described and whether or not the student may proceed with experimentation.

In some instances, a student may be required to work with a Qualified Scientist. (See Intel *International Science and Engineering Fair International Rules and Guidelines 2016* for more information). The completion of additional forms will also be required. The ISEF Rules Wizard is helpful for determining which forms you need. The Rules Wizard may be accessed at

https://apps2.societyforscience.org/wizard/index.asp

Below are examples of project ideas that were rejected due to the risks and hazards involved.

- Ingesting large amounts of caffeinated beverages to see what effects caffeine had on shooting an arrow at a target.
- Treating headaches with various over the counter headache remedies to see which one is the best in relieving a headache.
- Rapidly changing the temperature of a Beta fish's water to see how the change affects breathing.
- As someone drives through an obstacle course in a parking lot someone jumps out from behind a bush to determine how the driver's reaction time is affected.
- Exposing participants to prolonged exposure to the sun in order to evaluate the effectiveness of different types of sunscreens.
- Comparing the effects of conventional dry kibble versus raw meat diets on the agility course performance of competition border collies.

Research Plan

What is a Research Plan?

Your Research Plan will guide you as you conduct your experimentation; therefore it must be written and approved BEFORE you start your experimentation. You must complete Form 1A. You and your parent are to complete form 1B (complete only section 1). The Adult Sponsor is your science teacher. You must attach Student Checklist (1A) and Approval Form (1B). These forms are in this packet or may be typed and printed by accessing the forms at

https://student.societyforscience.org/forms

Your Research Plan should be written in the FUTURE TENSE because it describes what you WILL do to conduct your experiment and gather data.

Your Research Plan must include:

1. **RATIONALE**
   - What is the **RATIONALE** for your project? Include a brief synopsis of the background that supports your research problem and explain why this research is important scientifically and if applicable, explain any societal impact of your research.

2. **HYPOTHESIS (ES), RESEARCH QUESTION(S), ENGINEERING GOAL(S), EXPECTED OUTCOMES**
   - State your problem in question form. How is this based on the rationale described above?
   - State your hypothesis in an "If …then" format.

3. **Procedures**
   - Detail all procedures and experimental design including methods for data collection. Do not include steps such as "Gather my materials."
   - Identify your independent and dependent variables.
   - Identify your controls.
   - List the materials you will use. Include specific amounts when appropriate.
   - Describe only your project. Do not include work done by a mentor or others.

4. Risk and Safety
   - Identify any potential risks and safety precautions needed.

5. Data Analysis
   - Describe the procedures you will use to analyze the data/results that answer research questions or hypotheses.

6. Bibliography
   - List at least five (5) major references (e.g. science journal articles, books, internet sites) from your literature review. If you plan to use vertebrate animals, one of these references must be an animal care reference.

7. Discussion of Results and Conclusions
   - Discuss the data/results and the conclusions that can be drawn.

Below are subject-specific guidelines for additional items to be included in your research plan as applicable.

Human Participants Research

Participants
-Describe who will participate in your study (age range, gender, racial/ethnic composition).
-Identify any vulnerable populations (minors, pregnant women, prisoners, mentally disabled or economically disadvantaged).
Recruitment
-Where will you find your participants?
-How will they be invited to participate?
Methods
-What will participants be asked to do?
-Will you use any surveys, questionnaires or tests?
-What is the frequency and length of time involved for each subject?
Risk Assessment
-What are the risks or potential discomforts (physical, psychological, time involved, social, legal, etc.) to participants? How will you minimize the risks?
-List any benefits to society or each participant.
Protection of Privacy
-Will any identifiable information (e.g., names, telephone numbers, birth dates, email addresses) be collected?
-Will data be confidential or anonymous?
-If anonymous, describe how the data will be collected anonymously.
-If not anonymous, what procedures are in place for safeguarding confidentiality?
-Where will the data be stored?
-Who will have access to the data?
-What will you do with the data at the end of the study?
Informed Consent Process
-Describe how you will inform participants about the purpose of the study, what they will be asked to do, that their participation is voluntary and they have the right to stop at any time.
May require ISEF forms (see ISEF Rules Wizard https://apps2.societyforscience.org/wizard/index.asp
-Human Participants Form (4) with applicable consents and survey(s)
-Regulated Research Institution Form (1C), when applicable
-Qualified Scientist Form (2), when applicable

Vertebrate Animal Research

Briefly discuss potential **ALTERNATIVES** to vertebrate animal use and present a detailed justification for use of vertebrate animals.
Explain potential impact or contribution this research may have.
Detail all procedures to be used. -Include methods used to minimize potential discomfort, distress, pain and injury to the animals during the course of experimentation. -Detailed chemical concentrations and drug dosages.
Detail animal numbers, species, strain, sex, age, source, etc. -Include justification of the numbers planned for the research.
Describe housing and oversight of daily care.
Discuss disposition of the animals at the termination of the study.
May require ISEF forms (see ISEF Rules Wizard https://apps2.societyforscience.org/wizard/index.asp
-Regulated Research Institution Form (1C), when applicable
-Qualified Scientist Form (2), when applicable
-Vertebrate Animal Form(5A)
-Vertebrate Animal Form (5B)

Potentially Hazardous Biological Agents Research

Describe Biosafety Level Assessment process and resultant BSL determination.
Give source of agent, source of specific cell line, etc.
Detail safety precautions.
Discuss methods of disposal.
May require ISEF forms (see ISEF Rules Wizard https://apps2.societyforscience.org/wizard/index.asp
-Regulated Research Institution Form (1C), when applicable
- Qualified Scientist Form (2), when applicable
-Risk Assessment Form (3)
-Potentially Hazardous Biological Agents Risk Assessment Form (6A)
-Human and Vertebrate Animal Tissue Form (6B)

Hazardous Chemicals, Activities & Devices Research

Describe Risk Assessment process and results.
Detail chemical concentrations and drug dosages.
Describe safety precautions and procedures to minimize risk.
Discuss methods of disposal.
May require ISEF forms (see ISEF Rules Wizard https://apps2.societyforscience.org/wizard/index.asp
-Regulated Research Institution Form (1C), when applicable
-Qualified Scientist Form (2), when applicable
-Risk Assessment Form (3)

Websites to help you write your Research Plan

http://www.crest.wlwv.k12.or.us/cms/lib8/OR01001812/Centricity/Domain/1012/What_goes_into_research_plan.pdf

http://www.lcps.org/cms/lib4/VA01000195/Centricity/Domain/3552/SRP%205%2010-11.pdf

http://dallassciencefair.org

Log Book

Why do I need to keep a Log Book for my project?

Because you are thinking and working like a scientist, it is mandatory that you keep a log book. The log book is a chronological record of events during the experimentation. The log book can be a spiral bound notebook, journal book, binder, folder, etc.

The log book is to be displayed as a part of your science project at the science fair and should contain dated entries for the following:

- topic or question investigated
- background research
- hypothesis or prediction
- materials, procedures, safety precautions
- experimental results – both in graphical and written form
- conclusions/analysis
- bibliography

The following guidelines will help you when making entries in your logbook:

- Date each entry you make in your log book.
- Take notes as you work on your project and conduct your tests.
- Title each entry.
- Write legibly in clear understandable language.
- Use the active voice in the first person when making an entry to clearly show that it is your work.
- Record everything – include details, details, details.
- Use labeled illustrations and pictures.
- Use clearly labeled graphs and tables. Include the titles.
- Tape, staple, or glue graphs, tables, charts, and photos you may have used the computer to generate and print.
- Don't erase entries or tear out pages – real scientists keep ALL their work to analyze, draw conclusions, make adjustments, and improve their processes.
- Use the correct units (SI/metrics) for measurements.

ABSTRACT

What is an Abstract?

The Abstract is the last part of the project that needs to be written. It is written AFTER the project is complete. It is a short summary (maximum of 250 words or 1800 characters!) of your project that informs the reader about the main points of your project. An abstract includes:

- the purpose of the experiment,
- the procedure you followed for the experiment/test,
- data, and
- conclusions.

The abstract must be typed using the interactive form found at
https://member.societyforscience.org/document.doc?id=579

- Mark your category on the right of the form.
- At the bottom of the Abstract & Certification form are six questions. Read each carefully and answer appropriately.

You need 3 copies of your abstract to include with your project display.

Use the following as a guide in writing your abstract.

Purpose of the Experiment

- An introductory statement of the reason for investigating the topic of the project.
- A statement of the problem or hypothesis being studied.

Procedures Used

- A summarization of the key points and an overview of how the investigation was conducted.
- An abstract does not give details about the materials used unless it greatly influenced the procedure or had to be developed to do the investigation.
- An abstract should only include procedures done by the student. Work done by a mentor (such as surgical procedures) or work done prior to student involvement must not be included.

Observation/Data/Results

- This section should provide key results that lead directly to the conclusions you have drawn.
- It should not give too many details about the results nor include tables or graphs.

Conclusions

- Conclusions from the investigation should be described briefly.
- Conclusions should be based on the results of your investigation.
- Give a brief statement whether or not the results show that your hypothesis should be accepted. Give brief reason to support your answer.

Remember to

- Focus only on your research and omit details and discussions.
- Use the past tense when describing what was done. However, where appropriate use active verbs rather than passive verbs.

- Use short sentences, but vary sentence structure.
- Use complete sentences. Don't abbreviate by omitting articles or other small words in order to save space.
- Avoid jargon and use appropriate scientific language.
- Use concise syntax, correct spelling, grammar, and punctuation.

Websites to help you write an abstract

http://www.sciencebuddies.org/science-fair-projects/project_abstract.shtml

http://www.super-science-fair-projects.com/science-fair-project-abstracts.html

Abstract Example (248 words)

The purpose of this project was to determine if Vitamin A tablets have any effect on tomato plants. A total of twelve Rutgers tomato plants each two inches tall were planted in identical individual plastic pots using two cups of potting soil. Each plant received the same amount of water and sunlight during the three week experiment. The twelve plants were divided into four groups of three plants each. One vitamin A tablet was added to each of the three plants in the first group by burying the tablet one inch from the stem and one inch deep. Two vitamin A tablets were added to the second group of three plants in a similar manner. The third group of three plants had three tablets planted in the soil. The fourth group of three plants had no vitamin A tablets added to the soil and served as the control group. The height of each plant was measured and recorded at the start of the experiment and every 7 days thereafter. At the end of the experiment (21 days) the stems were cut across at a height of 3 inches. Experimental groups showed less development and slower growth rates than plants in the control group. The data was analyzed and the conclusion was drawn that giving vitamin A tablets to tomato plants did not improve growth as each of the three experimental groups failed to produce plants that were taller or had thicker stems than those in the control group.

Abstract Example broken down

- **Purpose The** purpose of this project was to determine if Vitamin A tablet have any effect on tomato plants.
- **Procedure A** total of twelve Rutgers tomato plants each two inches tall were planted in identical individual plastic pots using two cups of potting soil. Each plant received the same amount of water and sunlight during the three week experiment. The twelve plants were divided into four groups of three plants each. One vitamin A tablet was added to each of the three plants in the first group by burying the tablet one inch from the stem and one inch deep. Two vitamin A tablets were added to the second group of three plants in a similar manner. The third group of three plants had three tablets planted in the soil. The fourth group of three plants had no vitamin A tablets added to the soil and served as the control group. The height of each plant was measured and recorded at the start of the experiment and every 7 days thereafter. At the end of the experiment (21 days) the stems were cut across at a height of 3 inches.
- **Observation/Data/Results** Experimental groups showed less development and slower growth rates than plants in the control group.
- **Conclusions** The data was analyzed and the conclusion was drawn that giving vitamin A tablets to tomato plants did not improve growth as each of the three experimental groups failed to produce plants that were taller or had thicker stems than those in the control group.

EXAMPLE using the required form found at

https://member.societyforscience.org/document.doc?id=579

OFFICIAL ABSTRACT and CERTIFICATION

Do Vitamin A Tablets Affect Plants?

Ima Student

In the Middle Middle School, Boutte, LA, USA

The purpose of this project was to determine if Vitamin A tablets have any effect on tomato plants. A total of twelve Rutgers tomato plants each two inches tall were planted in identical individual plastic pots using two cups of potting soil. Each plant received the same amount of water and sunlight during the three week experiment. The twelve plants were divided into four groups of three plants each. One vitamin A tablet was added to each of the three plants in the first group by burying the tablet one inch from the stem and one inch deep. Two vitamin A tablets were added to the second group of three plants in a similar manner. The third group of three plants had three tablets planted in the soil. The fourth group of three plants had no vitamin A tablets added to the soil and served as the control group. The height of each plant was measured and recorded at the start of the experiment and every 7 days thereafter. At the end of the experiment (21 days) the stems were cut across at a height of 3 inches. Experimental groups showed less development and slower growth rates than plants in the control group. The data was analyzed and the conclusion was drawn that giving vitamin A tablets to tomato plants did not improve growth as each of the three experimental groups failed to produce plants that were taller or had thicker stems than those in the control group.

Category
Pick one only—mark an "X" in box at right

- Animal Sciences ☐
- Behavioral and Social Science ☐
- Biochemistry ☐
- Biomedical and Health Sciences ☐
- Cellular and Molecular Biology ☐
- Chemistry ☐
- Computational Biology and Bioinformatics ☐
- Earth and Environmental Sciences ☐
- Embedded Systems ☐
- Energy: Chemical ☐
- Energy: Physical ☐
- Engineering Mechanics ☐
- Environmental Engineering ☐
- Materials Science ☐
- Mathematics ☐
- Microbiology ☐
- Physics and Astronomy ☐
- Plant Sciences ■
- Robotics and Intelligent Machines ☐
- Systems Software ☐

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
   ☐ human participants ☐ potentially hazardous biological agents
   ☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue
2. I/we worked or used equipment in a regulated research institution or industrial setting: ☐ Yes ■ No
3. This project is a continuation of previous research. ☐ Yes ■ No
4. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☐ No
5. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only ☑ Yes ☐ No
6. I/we hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work. ☑ Yes ☐ No

This stamp or embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Scientific Review Committee.

DISPLAY

Do I have to have a display board?

- All students must prepare a display board to communicate his/her work to others.

What should my display look like?

1. The science project may not exceed 76 centimeters (30 inches) in depth (front to back), 122 centimeters (48 inches) in width (side to side), and 183 centimeters (72 inches) from the table top in height.
2. A *Science Fair Display Board Label* with your name, school name, grade, teacher, and project title must be attached to the back of the display board/exhibit. The label is included in this packet.

Attach to back of project

Science Fair Display Board Label

&

Science Fair Display and Safety Guidelines Checklist

3. If electricity is needed, the student must supply a UL approved extension cord of at least 9-feet in length.
4. All projects must meet Science Fair Display and Safety Guidelines. The *Science Fair Display and Safety Guidelines Checklist* must be completed by the student, signed and dated by both the parent/guardian and the student, and attached to the display board below the information label.
5. Your display must include your research plan, log book, and abstract.
6. You can include an interesting artifact to enhance your display as long as it is not prohibited or irreplaceable.

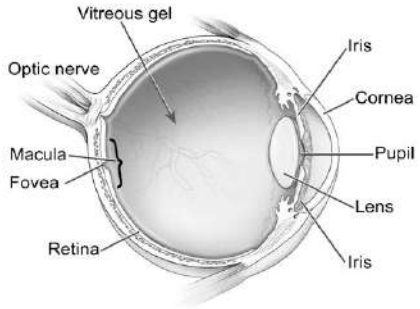
Photos/Images

- Any photos, images, and graphs used in the display must be credited.

- If you created all photos/images, a single credit is sufficient. The credit can be written on a card as a part of the display board or on a separate card on the display area.

I created all photographs and graphs. Ima Student

- If you use photos/images from another source you must credit the source. See example below.



https://nei.nih.gov/health/eyediagram

- Photos of human participants must have consent/release forms. The forms should be available with your project. If the photographed person is under 18, his/her parent must provide their consent. (see example consent form in this handbook)

Display Checklist

✓	**My display…**
	is neat, colorful and eye-catching
	has a catchy title.
	provides good information about my project by simply looking at it.
	includes all necessary parts and are labeled - a purpose statement/problem/question, a hypothesis, the procedure, data/results charts and graphs, analysis, conclusion.
	includes my procedures written in clear sequential order.
	shows that I conducted repeated trials and used adequate sample size.
	identifies my independent, dependent, and control variables.
	has the correct type of graph that displays my data along with a written explanation.
	has no spelling or grammatical errors.
	includes my research plan, my log book, and my abstract.
	has clear photographs/graphs/charts/tables that enhance my display and help to explain my project.
	includes my conclusion which answers my original question/problem supported with data.

Websites that can help you with your display

http://www.biologyjunction.com/diplay_board.htm

http://school.discoveryeducation.com/sciencefaircentral/Science-Fair-Presentations/How-to-Create-a-Winning-Science-Fair-Display-Board.html

http://sciencefair.math.iit.edu/display/

http://www.stevespanglerscience.com/blog/science-fair-secrets/science-fair-911-display-boards/

http://www.sciencebuddies.org/science-fair-projects/project_display_board.shtml

http://www.fcps.edu/PoplarTreeES/docs/scienceexpo/How%20to%20Set%20Up%20Your%20Science%20Board.pdf

PRESENTATION

Do I have to make a presentation?

All science fair participants are required to make a 2-3 minute presentation before the school's science fair judges and then respond to questions.

Be confident. You have worked like a scientist and part of being a scientist is being able to communicate to others about the work you have done, what you have learned, and what conclusions you have made.

Hints to Prepare for your Presentation

- Practice.
- Smile, relax, stand straight, and speak loudly enough to be heard clearly. (Don't chew gum!)
- Introduce yourself and tell your age and grade.
- Give the title of your project.
- Explain the purpose of your project and tell why you chose this topic.
- Explain your hypothesis and procedure.
- Show your results using your graphs, charts, and log book.
- Explain how you interpreted your data and the conclusion you have made.
- If you had encountered errors or problems, talk about them and explain what you did or could do to correct them.
- Tell the judges what you would do differently or what you would like to do next concerning your topic.
- Ask the judges if they have any questions. Answer questions with confidence. If the judges ask a question, you don't know, don't panic! You might say, "I'm not certain, but I think it might be…" or "That was not a part of my research or experimental plan but I will certainly look into finding the answer."
- Thank the judges for their time and attention.

Websites that can help you in preparing for your presentation

http://www.sciencebuddies.org/science-fair-projects/project_judging.shtml

http://www.education.com/reference/article/Ref_Science_Fair_Oral/

What if I place 1st, 2nd or 3rd …

…at my school fair?

Middle school students placing 1st, 2nd, or 3rd at their school fair are eligible to compete at the St. Charles Parish Science Fair. No ties for 1st, 2nd, and/or 3rd place will be allowed at the school science fair. Your teacher will provide you more information.

… at the Parish Fair?

Students placing 1st, 2nd, or 3rd at the St. Charles Parish Science Fair are eligible to compete at the **Region 10 Science and Engineering Fair held at Nicholls State University**. No ties for 1st, 2nd, and/or 3rd place will be allowed at the St. Charles Parish Science Fair.

- As you exit the stage at the Parish Fair, You will receive a packet to complete for the Regional Fair. If you wish to compete at the Fair, you will need to complete the packet and return it to the designated person at your school by the deadline. The turn-around time between the Parish Fair and the Regional Fair is extremely short, so you can't miss the deadline if you want to participate.
- School Science Fair Coordinators assist students in completing their registrations.
- Schools pay their students' registration fees. Students who register for the Region 10 fair and then do not participate are expected to reimburse the school for their registration fees.
- The district provides bus transportation for students to and from Nicholls State.

http://www.nicholls.edu/continuing-ed/science-fair/

… at the Region 10 Science & Engineering Fair at Nicholls State University and am eligible to participate at the Louisiana State Science & Engineering Fair?

Students who place at the Region 10 Science and Engineering Fair may qualify for **the Louisiana Science and Engineering Fair held at LSU.**

- School Science Fair Coordinators assist students in completing their registrations.
- Schools pay their students' registration fees. Students who register for the LSEF and then do not participate are expected to reimburse the school for their registration fees.
- Parents provide transportation and lodging for their children who participate at the State

https://is.lsu.edu/newdoce/lsef/State.asp

Glossary

Abstract – a 250 word summary of the project's purpose, procedure, data, conclusion. (See pages 20 -21) must be typed. For the form go to
https://member.societyforscience.org/document.doc?id=24

Adult Sponsor – the student's science teacher

IRB - Institutional Review Board; A committee composed of an educator, a school administrator, and a representative from the medical field who evaluates the potential physical and/or psychological risk of **research involving humans**.

ISEF- International Science and Engineering Fair. Rules and Guidelines may be accessed at:
https://member.societyforscience.org/document.doc?id=398

Qualified Scientist – someone trained and certified in a specific area of science who supervises the student as experimentation is conducted (e.g., veterinarian, licensed lab technician, physician) (See ISEF International Rules and Guidelines page 5)
https://member.societyforscience.org/document.doc?id=398

Research Plan – a detailed plan that outlines/describes the proposed science project (See page 18) Must accompany Student Checklist (1A) and Approval Form(1B). Go to:
https://member.societyforscience.org/document.doc?id=14

SRC – Science Review Committee; a group of qualified individuals that is responsible for evaluation of student research, certifications, research plans, and exhibits for compliance with the Rules and pertinent laws and regulations. Reviews projects involving vertebrate animals and/or potentially hazardous biological agents.

FORMS

Tell me again, what forms do I need and where can I find them?

Following this page are the Science Fair Forms needed by every Science Fair Participant.

- Science Fair Display Board Label
- Science Fair Display and Safety Guidelines Checklist
- St. Charles Parish Junior/Senior Division Science Fair Entry Form
- ISEF Student Checklist (1A)*
- ISEF Approval Form(1B)*
- Science Fair Project Statement of Compliance

***It is preferable that ISEF forms are typed.** Interactive forms may be accessed at

https://student.societyforscience.org/forms

Projects involving human participants, vertebrate animals, potentially hazardous biological agents or hazardous chemicals, activities, and devices require additional forms.

- The ISEF Rules Wizard is helpful for determining which of these forms you need. The Rules Wizard may be accessed at
  https://apps2.societyforscience.org/wizard/index.asp

Science Fair Display Board Label

Cut out and tape on the upper back of the left flap of your project board.

PLEASE PRINT ALL INFORMATION

NAME_____

SCHOOL_____ GRADE_____

TEACHER_____

TITLE OF PROJECT_____

SCIENCE FAIR DISPLAY AND SAFETY GUIDELINES CHECKLIST

- **All projects MUST adhere to the Science Fair Display and Safety Guidelines listed below. Failure to comply will result in disqualification.**
- **This completed and signed form is to be attached to the back of the project board.**

___ 1. Exhibit Size - W 48" X D 30" X H 108" maximum (floor to top)

___ 2. Student's name, school, grade, teacher, and project title are written on a 3 x 5" index card and attached to the back of the self-supporting display board/exhibit.

___ 3. Science Project Notebook/Data Collection pages (grades 4 and 5) or Science project log/book (grades 6 -12) Is displayed with the project board/exhibit.

___ 4. Three (3) copies of abstract and required forms are displayed with project board/exhibit. (grades 6-12 only)

___ 5. UL approved extension cords with grounded plug, all connections soldered; no uninsulated wire, nails, or tacks

___ 6. No quarantined substances

___ 7. No living organisms (e.g., plants, animals, microbes)

___ 8. No plant materials (living, dead, or processed). Exception: Manufactured materials used to build display.

___ 9. No microbial cultures and fungi, live or dead, including unknown specimens objects, or other objects dangerous to public safety

___ 10. No taxidermy specimens or parts

___ 11. No preserved vertebrate or invertebrate animals (includes embryos)

___ 12. No human or animal food

___ 13. No human/animal parts or body fluids (e.g., blood, urine) (Exceptions with SRC approval: teeth, hair, nails, dried animal bones, histological dry mount sections, and wet mount tissue slides)

___ 14. No soil, sand, rocks or waste samples unless encased in an acrylic slab

___ 15. No laboratory chemicals including water

___ 16. No liquid or solid gases (this includes water)

___ 17. No poisons, drugs, controlled substances, hazardous substances or devices (e.g., firearms, weapons, ammunition, reloading devices, gun powder)

___ 18. No dry ice or sublimating solids

___ 19. No sharp items (e.g., syringes, needles, pipettes, knives, scalpels)

___ 20. No flames open or concealed, no explosives, no noxious fumes

___ 21. No highly flammable display materials

___ 22. No batteries with open top cells

___ 23. No photographs or other visual presentations depicting vertebrate animals in other than normal conditions (e.g., surgical techniques, dissections)

___ 24. No glass, including containers, test tubes, thermometers, etc. (exception: computer screen)

___ 25. No empty tanks that previously contained combustibles, liquids or gases, unless purged with carbon dioxide

My science project meets all the display and safety guidelines listed above.

_____ _____ _____ _____

Student Signature | Parent/Guardian Signature | Date

ST. CHARLES PARISH SCIENCE FAIR

JUNIOR/SENIOR DIVISION

ENTRY FORM

PLEASE CLEARLY PRINT ALL INFORMATION

_____ Junior Division (Grades 6-8) _____ Senior Division (Grades 9-12)

Name _____Grade_____

School _____

Category: (Check One)

____Animal Sciences	____Behavioral/Social	____Biochemistry	____Biomedical & Health	____Cellular/Molecular
____Chemistry	____Computational Biology & Bioinformatics	____Earth & Environmental	____Embedded Systems	____Energy: Chemical
____Energy: Physical	____Engineering Mechanics	____Environmental Engineering	____Materials Science	____Mathematics
____Physics/Astronomy	____Plant Sciences	____Robotics & Intelligent Machines	____Systems Software	

TITLE OF PROJECT _____

Brief description of the project: _____

_____

_____

Electricity required? ____Yes ____No (**Participant must furnish a 9-foot or longer extension cord.)**

I agree to remain throughout the judging and to keep my project up until the end of the awards ceremony.

_____
Participant's Signature

I certify that the student above placed 1st, 2nd, or 3rd at our school's science fair and is eligible to compete at the St. Charles Parish Science Fair.

_____ _____
School's Science Fair Coordinator's Signature Date

Student Checklist (1A)

This form is required for ALL projects.

1. a. Student/Team Leader: _____ Grade: _____

   Email: _____ Phone: _____

   b. Team Member: _____ c. Team Member: _____

2. Title of Project:

   _____

3. School: _____ School Phone: _____

   School Address: _____

   _____

4. Adult Sponsor: _____ Phone/Email: _____

5. Does this project need pre-approval? ☐ Yes ☐ No Tentative start date: _____

6. Is this a continuation/progression from a previous year? ☐ Yes ☐ No
   If Yes:
   a. Attach the previous year's ☐ Abstract **and** ☐ Research Plan
   b. Explain how this project is new and different from previous years on ☐ Continuation/Research Progression Form (7)

7. This year's laboratory experiment/data collection:

   _____ _____

   Actual Start Date: (mm/dd/yy) End Date: (mm/dd/yy)

8. Where will you conduct your experimentation? (check all that apply)
   ☐ Research Institution ☐ School ☐ Field ☐ Home ☐ Other: _____

9. List name and address of all non-school work site(s):

   Name: _____ _____

   Address: _____ _____

   _____ _____

   Phone: _____ _____

10. **Complete a Research Plan/Project Summary following the Research Plan instructions and attach to this form.**

11. **An abstract is required for all projects after experimentation.**

Approval Form (1B)

A completed form is required for each student, including all team members.

1. To Be Completed by Student and Parent

a. Student Acknowledgment:

- I understand the risks and possible dangers to me of the proposed research plan.
- I have read the Intel ISEF Rules and Guidelines and will adhere to all International Rules when conducting this research.
- I have read and will abide by the following Ethics statement

Scientific fraud and misconduct are not condoned at any level of research or competition. Such practices include plagiarism, forgery, use or presentation of other researcher's work as one's own, and fabrication of data. Fraudulent projects will fail to qualify for competition in affiliated fairs and the Intel ISEF.

Student's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

b. Parent/Guardian Approval: I have read and understand the risks and possible dangers involved in the **Research Plan.** I consent to my child participating in this research.

Parent/Guardian's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

2. To be completed by the local or affiliated Fair SRC

(Required for projects requiring prior SRC/IRB APPROVAL. Sign 2a or 2b as appropriate.)

a. Required for projects that need prior SRC/IRB approval BEFORE experimentation (humans, vertebrates or potentially hazardous biological agents).

The SRC/IRB has carefully studied this project's **Research Plan** and all the required forms are included. My signature indicates approval of the **Research Plan** before the student begins experimentation.

SRC/IRB Chair's Printed Name

Signature

Date of Approval (mm/dd/yy) (Must be prior to experimentation.)

OR

b. Required for research conducted at all Regulated Research Institutions with no prior fair SRC/IRB approval.

This project was conducted at a regulated research institution **(not home or high school, etc.)**, was reviewed and approved by the proper institutional board before experimentation and complies with the Intel ISEF Rules. **Attach (1C) and required institutional approvals (e.g. IACUC, IRB).**

SRC Chair's Printed Name

Signature

Date of Approval (mm/dd/yy)

3. Final Intel ISEF Affiliated Fair SRC Approval (Required for ALL Projects)

SRC Approval After Experimentation and Before Competition at Regional/State/National Fair

I certify that this project adheres to the approved **Research Plan** and complies with all Intel ISEF Rules.

Regional SRC Chair's Printed Name	Signature	Date of Approval
State/National SRC Chair's Printed Name *(where applicable)*	Signature	Date of Approval

Science Fair Project

Statement of Compliance

I have reviewed the science project handbook and understand the rules and regulations regarding science projects.

I understand that I am expected to complete an individual project and present my project to a team of judges at the school science fair.

Teacher's Name_____ Grade_____

Printed Student Name_____

Student Signature_____Date_____

Parent/Guardian Signature_____Date_____

Parent/Guardian Phone number(s) _____