

## Junior & Senior Division (6-12)

**Students in Junior Division (grades 6-8) and Senior Division (grades 9-12) may compete in the following categories:**

Category	Examples	Related Categories
<p><b>J1. Aerodynamics/Hydrodynamics (Junior Division Only):</b> Studies of aerodynamics and propulsion of air, land, water and space vehicles; aero/hydrodynamics of structures and natural objects. Studies of the basic physics of fluid flow.</p>	<p>Effect of Dimples on Golf Ball Flight; Airfoil Stall Characteristics; Effect of Fins on Water Rocket Stability; Low Drag Launch Lug for Model Rockets.</p>	<p>Ballistics studies comparing other than different shapes or surface textures belong in Materials Science or Applied Mechanics. Senior Division projects otherwise appropriate for this category belong in Applied Mechanics.</p>
<p><b>J2. Alternative Energy (Junior Division Only):</b> Studies of power generation using alternative energy technologies such as solar cells.</p>	<p>Analysis of Nanocrystal Dyesensitized Solar Cells; Maximizing the Power Output of a Crystalline Silicon Photovoltaic Module through the use of Solar Concentrators.</p>	<p>Aerodynamic studies on turbines belong in Aerodynamics/Hydrodynamics. Hydroelectric projects generally belong in Electronics and Electromagnetics. Senior Division projects otherwise appropriate for this category belong in the relevant basic science (e.g., Physics &amp; Astronomy, Electronics &amp; Electromagnetics, Chemistry).</p>
<p><b>JS3. Applied Mechanics &amp; Structures:</b> Studies concerning the design, manufacture, and operation of mechanisms, including characteristics of materials, dynamic response, and active/passive control. Testing for strength and stiffness of materials used to provide structural capability; studies and testing of structural configurations designed to provide improved weight and force loading or stiffness capabilities. Senior Division only: includes aerodynamics, hydrodynamics, and fluids projects.</p>	<p>An Underwater Glider for Marine Exploration; Measurement of CD Variations; Tensile Strength of Composite Materials; Bridge Design; Can Foam Make Steel Stronger?; How Does Arch Curvature Affect Strength?; How Do Different Foundations Stand Up to Earthquakes? Senior Division: "Arrow" Dynamics; Measuring the Effect of Aerodynamic Design on Vehicular Drag.</p>	<p>Junior Division aerodynamics/hydrodynamics projects belong in Aerodynamics/Hydrodynamics. Engineering studies of soil stability during earthquakes belong in Earth &amp; Planetary Sciences.</p>
<p><b>JS4. Behavioral &amp; Social Sciences:</b> Studies of human psychology, behavior, development, linguistics, and the effects of chemical or physical stress on these processes. Experimental or observational studies of attitudes, behaviors, or values of a society or groups within a society, and of the influences of society on group behavior. Includes gender and diversity studies, anthropology, archaeology, and sociology. Studies may focus on either normal or abnormal behavior. Senior Division only: includes studies of cognition.</p>	<p>A Study of the Senses in Stress Management; Racial Awareness in Infants; AIDS Awareness in Teens; The Effect of Authority Figures on Group Decision Making.</p>	<p>Animal behavior projects belong in Zoology or Mammalian Biology. Junior Division projects studying memory, learning, and sensory perception belong in Cognitive Science.</p>

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<p><b>JS5. Biochemistry/Molecular Biology:</b> Studies at the molecular, biochemical, or enzymatic levels in animals (including humans), plants, and microorganisms, including yeast. Studies of biological molecules (e.g., DNA, RNA, proteins, fats, vitamins, nutrients).</p>	<p>Lipooxygenase Influence on Lipofuscin Granule Formation in Bananas; Effects of P1 Precursors on Virus Growth; Isolation of PremRNA Mutants in <i>Saccharomyces cerevisiae</i>; Determination of Ascorbic Acid Concentration in Orange Juice Using a Redox Reaction; Effects of Food Preparation on Vitamins.</p>	<p>Studies of the physical properties of biochemical such as oxidation-reduction reactions belong in Chemistry. Functions of major organ systems belong in Mammalian Biology or Zoology.</p>
<p><b>JS6. Chemistry:</b> Studies in which chemical properties of nonbiological organic and inorganic materials (excluding biochemistry) are observed.</p>	<p>Isolation, Purification, and Specific Rotation Determination of Ricinoleic Acid; Conductivity of Electrolytes; Does Water Purity Affect Surface Tension?</p>	<p>Chemical studies of metabolic processes (e.g., fermentation and/or yeast), processes mediated by biochemical intermediates (e.g., enzymes), or biological organic molecules belong in Biochemistry. In the Junior Division projects that deal with the characterization of chemical products in everyday life belong in Materials Science or Product Science (Physical).</p>
<p><b>J7. Cognitive Science (Junior Division Only):</b> Studies of learning memory, and cognition in humans, using human or animal models for human processes. Studies of the effects of chemical or physical stress on cognition. Includes projects on subliminal perception, optical illusions, recall and observations (e.g., reliability of eyewitnesses), and the interaction of different senses.</p>	<p>Does Age Affect Implicit Learning?; The Effectiveness of Flash Cards vs. Computer Scripts; Optical Illusions; Subliminal Persuasion by Television; Eyewitness Identifications; Effect of Curcumin on Memory.</p>	<p>Studies examining basic human senses and physiological, rather than psychological, reactions belong in Mammalian Biology. Senior Division projects otherwise appropriate for this category belong in Behavioral and Social Science.</p>
<p><b>JS8. Earth and Planetary Sciences:</b> Studies in geology, seismology, engineering geology, atmospheric physics, weather, physical oceanography, marine geology, and costal processes.</p>	<p>Gravity Current Velocities; Beach Sand Fluctuations and Cliff Erosion; Dependence of Liquefaction upon Soil Composition; Influence of Site Effects on Peak Ground Acceleration in Northridge and Whittier Narrows Earthquakes; Solar Activity and Refraction Properties of the Ionosphere.</p>	<p>Studies concerning pollution caused by human activity belong in Environmental Science. Earthquake engineering projects (other than soil stability) belong in Applied Mechanics &amp; Structures.</p>

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<p><b>JS9. Electronics and Electromagnetics:</b> Experimental or theoretical studies with electrical circuits, computer design, electro-optics, electromagnetics applications, and antennas.</p>	<p>Satellite Reception Without a Dish; The Gauss Rifle; Transmission of Information by Laser; Are Maglev Trains Practical?</p>	<p>Projects that merely use electronics to study something else (e.g., hearing in birds) belong in another category (Zoology in this example).</p>
<p><b>J10. Environmental Engineering (Junior Division Only):</b> Projects which apply technologies such as recycling, reclamation, restoration, composting, and bioremediation which could benefit the environment and/or the effects of pollution on the environment.</p>	<p>Newspapers as Mulch; Oil Control; Water Hyacinth; Primary Water Treatment?; What Soil Conditions Best Control Soil Erosion While Assisting Growth?; Designing a New Sewer System.</p>	<p>Senior Division projects otherwise appropriate for this category belong in Environmental Science.</p>
<p><b>JS11. Environmental Science:</b> Projects surveying, measuring, or studying the impact of natural and manmade changes on the environment. Examples include: floods, fires, bio hazardous spills, acid rain, earthquakes, air pollution, and water pollution.</p>	<p>The Effects of Fires on Flora and Fauna; How Does Water Quality Affect the Abundance and Diversity of Micro-invertebrates; Bacteria Pollution in Our Beaches; An Analysis of Dissolved Oxygen and Density in Ballona Creek.</p>	<p>Studies performed under unrealistic or simulated conditions to examine the effect of substances or conditions on living things belong to Pharmacology/ Toxicology or the relevant basic science category (e.g., Plant Biology, Mammalian Biology, Zoology, etc.).</p>
<p><b>JS12. Mammalian Biology:</b> Studies of growth and developmental biology, anatomy, and physiology in all mammals, including humans. Studies of the behavior of all mammals in their natural habitats (or reproductions of them).</p>	<p>Effects of Age on Aerobic Abilities; Peripheral Vision; Correlation of Strength with Gender; Effect of Vaccination on Antibody Development in Neonatal Bovines; Lung Capacity, Age, and Exercise; Crossed Hand-Eye Dominance.</p>	<p>Projects studying physiology of birds, insects, et. belong in Zoology. Studies of the effect of chemicals on a physiological function may belong in Pharmacology/ Toxicology. Studies in which animals serve as a model for human learning or behavior belong in Cognitive Science (Jr) or Behavioral &amp; Social Sciences (Sr.)</p>
<p><b>J13. Materials Science (Junior Division Only):</b> Studies of materials characteristics and their static (not in motion) physical properties. Includes measurements and comparisons of materials durability, flammability, and insulation properties (thermal, electrical, acoustic, optical, electromagnetic, etc.).</p>	<p>Which Metal Conducts the Most Heat?; What is the Effect of Duct Tape as an Insulation Material?; Sun Protection on the Courts: A Test of Colors and Materials in Tennis Clothing; Which Building Material Disrupts a Wireless Connection the Least?</p>	<p>Studies of fundamental properties of matter (e.g., specific heat) belong in Physics and Astronomy. Studies comparing and testing natural and manmade products for effectiveness in intended use in real-world, consumer-oriented applications belong in Product Science (Physical).</p>

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<p><b>JS14. Mathematics &amp; Software:</b> Studies in geometry, topology, real and complex analysis, number theory, algorithm analysis and optimization, artificial intelligence, computability, computer graphics, modeling and simulation, programming environments and languages.</p>	<p>Maximally Dispersed Points on a Sphere; Computer Modeled Evolution; Knot Mathematics; Coupled Chaotic Systems and Stability; Mathematical Optimization of Multiple Precision Multiplication; Partitions of Positive Numbers; Neural Network Model of Vision.</p>	<p>Projects using mathematics or computers as a tool in the study of a different subject belong in that category. Studies that merely model or simulate biological or physical systems usually belong in this category. Computer hardware projects (e.g., comparing algorithm speed on different hardware platforms) belong in Electronics &amp; Electromagnetics.</p>
<p><b>JS15. Microbiology (General):</b> Studies of genetics, growth, and physiology of bacteria, fungi, protists, , algae, or viruses. Includes surveys of bacterial contamination. Senior Division Only: includes projects described within the category Microbiology (Medical).</p>	<p>Studies of Light Producing Bacteria; Enhancement of algae Lipid Composition through the Manipulation of Temperature, Light and Nutrient Levels; The utilization of Photobioreactor to Optimize the Growth Rate of Lipids in Microalga.</p>	<p>Projects studying photosynthesis or fermentation belong in Biochemistry. Projects using bacteria as a tool to study another subject belongs to that subject.</p>
<p><b>J16. Microbiology (Medical) (Junior Division Only):</b> Studies of prevention, diagnosis, and treatment of infectious diseases cause by pathogenic bacteria, fungi, or viruses. Includes all antimicrobial studies except testing of commercial antimicrobials.</p>	<p>Effect of Spices on Escherichia coli growth on food; Antibiotic Resistance in Bacteria; Effects of Hand Washing on Absenteeism in Schools.</p>	<p>Projects using bacteria as a tool to study another subject belongs to that subject. Testing of commercial antimicrobial products belongs in Product Science (Biological). Senior Division projects otherwise appropriate for this category in Microbiology (General).</p>
<p><b>JS17. Pharmacology/Toxicology:</b> Studies of the effects of chemicals, toxins, medicinal and nutritional factors (such as vitamins), prescription drugs, natural remedies, food components (caffeine), and potentially harmful factors (such as temperature, carbon dioxide, radiation) at the cellular or higher level on plants and animals.</p>	<p>Vitamin Deficiencies; Effect of Caffeine on Daphnia; Effects of Pyruvate Glucose Cocktail; Copper Toxicity of Marine Embryos; The Effects of Intermittent and Constant EMFs on Drosophila; The Effects of Petroleum Contaminated Water on Aquatic Plants.</p>	<p>Projects which study the effect of fertilizers on plant growth belong in Plant Biology. In the Junior Division, studies of the toxic effects of actual environmental changes on ecosystems belong in Environmental Science.</p>

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<p><b>JS18. Physics &amp; Astronomy:</b> Studies of the physical properties of matter, light, acoustics, thermal properties, solar physics, astrophysics, orbital mechanics, observational astronomy, and astronomical surveys. Computer simulations of physical systems are appropriate in this category.</p>	<p>Emissivity as a Function of Geometry; Do High Temperature Superconductors have a First Order Phase Transition?; Chaotic Pendulum; Photometric Detection of an Extrasolar Planetary Transit; Jupiter's Decametric Emission; Solar Activity and Geosynchronous Satellites.</p>	<p>Electromagnetic propagation studies (e.g., antennas) belong in Electronics &amp; Electromagnetics. Junior Division projects studying the characteristics of materials such as insolation properties belong in Materials Science. Projects concerning the study of soils/rocks from planetary objects belong in Earth &amp; Planetary Sciences.</p>
<p><b>JS19. Plant Biology:</b> Studies of the genetics, growth, morphology, or physiology of plants. Studies on the effects of fertilizers on plants.</p>	<p>The Effects of Organic &amp; Inorganic Fertilizers on Plant Growth; Effect of Rhizobium on Legume Plants (Pisum); Transpiration of Plants Under Different Light Sources.</p>	<p>Studies using plants for indication or remediation of environmental pollution belong in the appropriate environmental category. Studies on plants belong in Pharmacology/Toxicology.</p>
<p><b>J20. Product Science (Biological) (Junior Division Only):</b> Comparison and testing of commercial off-the-shelf products (except antimicrobials) for quality and/or effectiveness for intended use in real-world consumer-oriented applications. This category is reserved for experimental methods involving biological sciences and processes.</p>	<p>Preventing Pumpkin Decomposition; Antibacterial Soap vs. Antibacterial Gel: Cause for Concern?; Tylenol Brand vs. Store Brand Acetaminophen; Does Orange Oil Really Work?</p>	<p>Biological studies that do not include a commercial off-the-shelf product but are only testing potentially new consumer applications belong in their respective Life Science Category; Junior Division projects studying antimicrobial effectiveness belong in Microbiology (Medial). Senior Division projects otherwise appropriate for this category belong in the relevant basic science.</p>
<p><b>J21. Product Science (Physical) (Junior Division Only):</b> Comparison and testing of commercial off-the-shelf products for quality and/or effectiveness for intended use in real-world consumer-oriented applications. This category is reserved for experimental methods involving non-biological, physical sciences and processes.</p>	<p>Water Absorption in Eight Selected Hardwoods With and Without Sealants; Best Plywood for Homemade Skateboards; Cotton, Linen, Wool: Which One Lasts Longer?; Fire Resistance Roofing Materials; Which Laundry Detergent Works the Best? Shock Attenuation in Baseball Helmets.</p>	<p>Non-biological studies that do not include a commercial off-the-shelf product but are only testing potentially new consumer applications belong in their respective Physical Science category. Senior Division projects otherwise appropriate for this category belong in the relevant basic science.</p>

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<b>JS22. Zoology:</b> Studies of the growth and developmental biology, anatomy, and physiology in animals other than mammals. Studies of the behavior of all animals (excluding mammals) in their natural habitats (or reproductions of them).	Hot Fish, Cold Fish: Respiration in Gold Fish; Hearing and the Dominance Hierarchy of Crickets; Effect of Gravity on Living Organisms; Invertebrates in Kelp Holdfasts; Auditory Stimuli in Interganglial Neurons of Acheta Domesticus; Bird Responses to Boar Rootings.	Studies of mammals belong in Mammalian Biology. Studies in which animals serve as a model for human behavior belong in Behavioral & Social Sciences.