

Handout II
Possible Topics
for
Science Fair Projects

by

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Other Sources of Information

- See following websites:
- <http://www.sciencebuddies.org/mentoring/science-fairs.shtml>
- <http://school.discovery.com/sciencefaircentral>
- <http://www.ipl.org/div/kidspace/projectguide>
- <http://www.all-science-fair-projects.com>
- <http://www.super-science-fair-projects.com>
- <http://www.scifair.org>
- <http://www.cdli.ca/sciencefairs>
- <http://www.members.ozemail.com.au/~macinnis/scifun/projects>
- See handouts

Possible Topics: Astronomy

- Descriptive and Comparative
- Astromechanics
- Astrophysics
- Cosmology
- Planetology

Possible Topics: Astronomy

- How much does the intensity of sunlight vary each day? ... Why?
- How do you take the temperature of a star?
- Why does the sky appear to be blue to a surface-based observer?
- What would be the pressure of the Earth's atmosphere at its surface if the earth was the mass of the moon? ... Jupiter?
- How would planetary motion change if the gravitational force decreased with $>$ square and $<$ square instead of the square of the distance between mass centers?

Possible Topics: Biology

- Descriptive, Comparative, and Taxonomic
- Evolutionary/Systematic
- Genetics
- Reproductive
- Developmental
- Physiology
- Structural/Molecular
- Functional
- Theoretical
- Ecology
- Exobiology/Astrobiology

Possible Topics: Biology

- The effect of some variable on seed germination, plant growth, or seed formation
- The effect of some variable on the growth or reproduction rates in the fruit fly or water flea
- The effect of some variable on the mutation rate of a plant or fruit fly or water flea
- Unambiguous criteria/tests for life on mars
- A model for hierarchical reading of the genetic code
- Pre-biological, self-organizing organic macromolecules

Possible Topics: Chemistry

- Analytical
- Astrochemistry
- Biological (Biochemistry)
- Cosmochemistry
- Environmental
- Inorganic
- Organic
- Organometallic/Metalloorganic
- Physical
- Polymer/Macromolecular
- Theoretical/Computational

Possible Topics: Chemistry

- The efficiency of over-the-counter antacids or dishwashing liquids
- The effect of some variable on freezing or boiling point of a liquid (e.g., water, alcohol)
- The effect of some variable on the solubility of a solid in a liquid, the rate of precipitation of a solid from saturated solution, or the crystal structure of the precipitate
- The effect of some variable on solute (e.g., tea) sorption to particles (e.g., powdered charcoal)
- The effect of oil molecule size on water solubility

Possible Topics: Biochemistry

- The effect of some variable on:
 - cell uptake of a limiting factor
 - cell energy production
 - production rate of a cell product or byproduct
- The effect of some variable on the cell aging rate
- The effect of some variable on somatic mutations in bacteria or algae
- Improving the effectiveness of sun screens
- Inducing and reversing pre- and cancerous transformations in an *in vitro* skin cell line by some variables

Possible Topics: Engineering

- Acoustical
- Aeronautical/Aerospace
- Chemical
- Civil
- Electrical
- Hydraulic
- Marine
- Materials
- Mechanical (including Fluid Mechanics)
- Power
- Systems

Possible Topics: Engineering

- Improving cement hardness with various additives
- Improving effectiveness of sonic toothbrushes
- Improving effectiveness of hurricane shutters
- Mapping distribution of electromagnetic fields outside and inside your house (incl. computer)
- Measuring work done by flowing water or blowing wind or pouring sand or hamster in wheel
- Improving effectiveness of sound-proofing materials or glass tints
- A novel design for reducing beach erosion

Possible Topics: Earth Science

- Geology
- Hydrology
- Hydrogeology
- Mineralogy
- Paleontology
- Weather

Possible Topics: Earth Science

- The effect of variables influencing erosive forces by wind and water
- The effect of variables on the infiltration rate of water through soil
- Are the processes governing or variables influencing water erosive forces and infiltration rates related?
- A novel method for estimating the age of wood, rocks, or the earth
- Simulating the effect of global warming on soil carbon storage or greenhouse gas emissions or on hurricane strength
- Chaotic patterns in natural systems

Possible Topics: Environment

- Effect of variables on algae growth in water
- Effect of variables on adsorption of bacteria or algae byproducts by powdered charcoal
- Effect of variables on bacteria killing efficiency of uv, iodine, and combined
- Effect of ozone on plant growth or mutation rates
- Effect of variables on the persistence of oil in freshwater or marine sediments
- Effect of canned tuna on fruit fly growth or mutation rates or worm or fish learning rates

Possible Topics: Mathematics

- Algebra
- Calculus
- Computer/Information Theory (including code making and breaking algorithms)
- Geometry (Euclidean and Non-Euclidean)
- Number Theory
- Operations Research
- Probability and Statistics
- Logic and Set Theory
- Topology

Possible Topics: Mathematics

- Solving Zeno's paradox
- Accuracy of numerical approxs. to functions
- The relationship between non-Euclidean geometries and non-linear functions
- Can complex numbers be prime numbers?
- Are there prime Euclidean or non-Euclidean geometric figures by analogy to prime numbers?
- Are there prime chaotic attractors by analogy to prime non-Euclidean geometric figures?
- New space-filling algebraic functions or calculi
- New logical calculi (see, e.g., G. Spencer Brown's "The Laws of Form")

Possible Topics: Computer Applications

- Patterns in computer-generated “random” nos.
- Accuracy of voice recognition algorithms
- Efficiency of password-breaking algorithms
- Efficiency of numerical integration schemes
- Accuracy or efficiency of learning algorithms
- Improving the accuracy or efficiency of pattern recognition programs or a novel program
- Limits to digital representation of analog systems
- Does Goedel’s Paradox preclude the programming of a set of algorithms that think?
- What types of problems are inherently inaccessible to quantum computing?

Possible Topics: Microbiology

- Sorting microbes by the type of dye or stain they take up
- Sorting microbes by gravitational, electrical, or magnetic fields
- The effect of some variable on the density or composition of microbial communities in soil or sediment
- Which mouth washes are the most efficient at killing mouth germs?
- The relationship between gum disease and heart disease
- Screening soils for new antibiotics using ELISA

Possible Topics: Physics

- Einsteinian Mechanics (Special and General Relativity)
- Electromagnetics
- Fluid Mechanics and Dynamics
- Newtonian Mechanics
- Nuclear
- Solid State
- Statistical Mechanics
- Thermodynamics (Equilibrium and Non-Equilibrium)
- Quantum Mechanics

Possible Topics: Physics

- The effect of variables on emission of light by heated elements
- The effect of variables on tire friction, auto body wind resistance, or wing lift
- The random walk as a model for the process of diffusion
- Ultrasonic heating and cooling
- A doped ice transistor or chemical laser
- Exploiting quantum tunneling in electronic devices
- Is light's speed dependent on earth's motion?
- Cold fusion warms up?

Possible Topics: Psychology

- The effect of some environmental variable on the learning rate of the ant, worm, or fish.
- Is reward or punishment the most effective for fostering learning efficiency in humans?
- How does background sound (noise, rap, rock n roll, jazz, classical) affect memorization rate and retention of memorized material in humans?
- Does the incidence of violent behavior increase with exposure to TV? ... computer games?
- A novel lie detector based on eye movement