

## PLANT PROJECT IDEAS (Botany)

- Do magnetic fields affect plant growth?
- Do different colors of light affect the direction of plant growth?
- Do sounds (music, noise, etc.) affect plant growth?
- What are the effects of acid rain on plant growth?
- Do household detergents affect plant growth?
- Does soil temperature affect root growth?
- Does caffeine affect plant growth?
- Does water salinity affect plant growth?
- Does freezing affect seed germination?
- Does burned soil affect seed germination?
- Does seed size affect plant height?
- Does fruit size affect the number of seeds in the fruit?
- Do vitamins or fertilizers promote plant growth better?
- Do fertilizers extend plant life during drought?
- Does leaf size affect plant growth rates?
- Do different types of artificial light affect plant growth?
- Does soil pH affect plant growth?

## Kitchen Chemistry:

- Does adding salt to water help it boil faster? Can you dissolve an egg shell? How can you dissolve an egg yolk? How does using oil in the pan affect how something cooks? What food items are most biodegradable? Do other fruits or vegetables work like red cabbage to create a pH indicator? How do cola products compare in acidity with other common drinks or food?
- Carbon dioxide (obtained from a baking soda, vinegar, and water mixture) can put out a candle flame; how does it work? What happens when you use different kinds of vinegar, like apple cider or balsamic, with the baking soda?
- Design a science fair project comparing and contrasting how long it takes ice and other frozen solids to melt at room temperature compared to a warm stovetop or the refrigerator.
- What difference does salt make to the melting point? What other substances work the same way? Which is more efficient for melting ice - salt, or a commercial de-icing chemical?
- Test several different types of cereal or juice to do a comparative study on which product contains the most sugar, vitamin C, etc. Do you expect that cereal made for children has

more sugar in it than cereal made for adults? Use Benedict's solution to identify the presence of sugar.

- Using Benedict's solution, test "diet" foods/drinks for glucose and compare with their regular counterparts. Does the presence of artificial sweetener decrease the amount of glucose?
- Do juices that claim to have more vitamin C really have more vitamin C than their counterparts? Does cooking affect the amount of vitamin C or other nutrients found in food? Use indophenol to test for the presence of vitamin C.
- Test several of your favorite foods to determine which food is the healthiest for you and which is the worst for you. Use Sudan III or a paper bag test to identify lipids (fats) in the food. Use Biuret reagent to identify the presence of protein. Use Lugol's iodine solution to identify the presence of starch. (You can do this project and the previous three with our Chemistry of Food kit.
- Does water conduct electricity? Can you add something to it to help it do so?
- How does temperature affect the density of different liquids?

### Metals:

- Pennies can be used to make a battery or plate an iron nail, without damaging them. Experiment to see if pennies minted before 1982 (when they were 95% copper) provide more power or a thicker coating than newer pennies do (with only 2.5% copper). Do other metals work as well for batteries or plating a nail?
- Which pH level is most conducive to corrosion in iron or copper? Try suspending iron or copper electrodes in solutions with different pH levels (try water and vinegar, for starters). Use pH papers for the tests.

### Mixtures and Compounds:

- How can you separate mixtures into the compounds that make them up? Experiment with different ways to distill potable (drinkable) water from salt water.
- Do a chromatography test to determine what colors make up similar lipstick (or other cosmetics) colors in different brands? You can also test what dyes are found in juice mixes or colored markers. How do forensic scientists use chromatography?
- Most people in the U.S. and Canada wash their clothes with synthetic laundry detergents rather than real "soap." What are some differences in the properties of each, and which do you think gets clothes cleaner? Come up with a similar experiment comparing face wash to face soap.
- What is the difference between hard water and soft water? How do things like bath salts help counteract the effects of hard water?

- Explore methods of extinguishing fires. What can you use to put out a candle flame besides water? (Be careful!)
- Different elements give off different types of light when they burn. See if you can determine what elements are present in different types of lighting using spectroscopy analysis.
- Experiment with polymers that can expand in water, turn a liquid into a solid, and more. Design a project about surface tension, polarity, osmosis, saturation, viscosity, molecular bonding, etc.
- Grow and experiment with crystals: Does temperature have an effect on the growth rate of crystals? What about leaving them covered or uncovered? Does dry air or moist air seem to grow more crystals?

## Astronomy

- Use a spectroscope to identify and compare the elements of different stars (e.g., look at a blue star like Sirius compared to a red one like Betelgeuse).
- What is the best design you can come up with for a homemade astrolabe?
- Use historical data and current conditions to find out how the number of sunspots affects Earth's weather. Can this information be used to accurately predict weather patterns on the earth?
- Use a radio to measure changes in the ionosphere. Will ionosphere activity be more in the day than in the night? Will solar flares affect ionosphere activity?
- What kind of weather conditions are the best for stargazing? Are all clear nights equally good, regardless of temperature? Can you measure the effect of light pollution on stargazing in your city? (Use a star map and compare which stars you can see in your backyard to which ones you can see in the dark countryside.)

## Geology

- Use a mineral test kit to identify rocks and minerals in your experiments.
- Experiment with a black light to test for fluorescent minerals. Do the same minerals fluoresce under longwave versus shortwave UV light?
- Do different types of rocks in the soil affect plant growth?
- How does soil management affect soil quality?
- Do different types of rock affect road stability?
- Earth's movement beneath the surface changes the appearance of the earth's surface. Do different soil types move in different patterns when the same type of movement is applied?
- What factors speed up erosion, and what methods can be used to prevent erosion?

- How do crystals form, and what factors affect the rate at which they form?

## Volcanoes & Earthquakes

- Can you design model structures that are 'earthquake' resistant?
- Does the type of soil under and around a building affect how much damage an earthquake could cause? Do different soil types relate to the phenomenon of liquefaction during an earthquake?
- Does previous strain on a building affect its ability to withstand an earthquake?
- Are human burps similar to volcanic eruptions?
- Does temperature affect the viscosity of lava? Does this affect how explosive a volcano's eruption is?
- Can you build a volcano to test the theory of how temperature affects lava or the explosiveness of eruption?
- Experiment to demonstrate why some fumaroles produce more steam than others.

## Weather

- Use weather instruments to answer questions like 'How can I predict which time of day will have the highest temperature?' or 'When is a storm most likely to hit my area?'
- How well can you forecast weather by observing clouds and wind direction?
- Are there places very close to your location that get more or less rainfall than you? If so, try to discover what factors are involved.
- Does heat or dry wind evaporate water faster? Do you have ideas how you might slow down evaporation?
- Dealing with the consequences of more wild weather, explore the effects of tsunamis or hurricanes on the shoreline. Does human manipulation of the environment affect how well the shoreline can minimize destruction on land caused by hurricanes and tsunamis?
- How do hot and cold air circulate to form different weather patterns? How does this relate to barometric pressure, and how is pressure used to forecast storms?
- Does an ocean breeze blow in the same direction during the day as during the night? What is the relation of the air temperature to the water temperature during the day versus during the night?

## Earth Science

- Explore methods of erosion prevention, test effects of different soil composition on erosion (e.g. how does more clay compare to more sand?).
- Experiment with methods of flood management and containment.

- Investigate the effects of sunspots on weather patterns.
- Work with methods for forecasting weather.
- Test the concentration and effect of minerals and pH in soil and water samples. (Use water test strips and a soil analyzer.)
- Determine chemical makeup of rain in your area; test possible hazardous effects.
- Physical Science
- Study acoustic models and methods of noise control. (A sound measurement kit might be helpful.)
- Experiment with the effect of storage temperatures on batteries.
- Develop improvements in battery chargers; try methods of using solar cells to recharge batteries.
- Compare the bending strength and durability of different building materials.
- Experiment with building materials that are fire-preventative.
- Design industrial uses of magnets; test the effects of magnetic and electromagnetic fields on living organisms such as brine shrimp.
- Design a project in advanced robotic programming.

## Chemistry

- Test the effects of the pH level of a solution on the corrosion of iron and copper; explore different methods of corrosion prevention.
- Experiment with types, effectiveness, and the impact on nutritional value of preservatives in food.
- Compare the properties and effects of artificial sweetener vs. sugar or other natural sweeteners. (For this and the following tests, you might consider the Chemistry of Food kit.)
- Test the chemical properties and physiological impact of saturated, unsaturated, and trans fats.
- Use indophenol to test the effect of different cooking methods on the depletion of vitamin C in food.
- Investigate the role of enzymes and yeast in the fermentation or cheese-making process.
- Experiment with different methods of water filtration/purification (such as solar distillation).
- Analyze the by-products of gasoline; compare efficiency of various octane levels.

## Environmental Science

- Compare or develop methods of hydrogen production and storage for use in fuel cells.

- Investigate methods of improving home insulation.
- Experiment with expanded uses of solar energy.
- Test methods for cleaning up and neutralizing the effect of oil in salt water with this oil spill cleanup kit.
- Work with methods of processing/recycling non-biodegradable items; experiment with decomposition aids.
- Experiment with design and function of wind turbines or water wheels.
- Test for harmful effects of pesticides; test or develop natural/organic alternatives; test the effectiveness of common pesticides such as DEET.
- Which type and color of roofing material provides the most energy efficiency?

### Electricity & Magnetism:

- Experiment with static electricity. How can you create it? How you can reduce it? What substances or objects are the best conductors of static electricity? Do conditions like humidity and temperature increase or decrease static electricity?
- Make electromagnets with different strengths; compare their magnetic fields using iron filings to find what effect they have on a compass needle and how strong their attraction is (e.g., which one can pick up the most paperclips?).
- Make a voltaic cell and research which household electrolytes are most effective for producing electricity. How well does a carbon rod instead of a metal rod work as a positive electrode?
- Can you use a magnet to find traces of iron in food, dollar bills, and other household materials?
- Make a crystal radio. What indoor and outdoor materials (such as metal poles, a window, etc.) make the best antennas for your radio? Under what conditions, such as temperature, cloud cover, and humidity, does your radio pick up the clearest signals?
- What types of liquid can conduct electricity? Can electricity be used to split water into hydrogen and oxygen?
- Experiment with how magnetic and electric fields can make a magnet fall in slow motion. How could this principle be applied to real-world technology, like braking systems on roller coasters?
- Explore maglev technology (magnetic levitation).

### Force & Motion:

- What are the best shapes for paper airplanes? The best material for propellers?
- Experiment with thrust and aerodynamic design while launching a rocket.

- Design an experiment using a rocket car powered by a balloon.
- Create an experiment showing how well (or poorly) different structures or materials withstand pressure.
- How do different brands of plastic wrap compare when stretched with equal force? How do different brands of duct or clear tape compare in strength and stickiness? Can you identify what factors cause one to perform better than another?
- What type of flooring (carpet, wood, tile, linoleum, etc.) creates the most or the least friction? (Younger kids might test this by rolling a ball or toy truck over different surfaces. Older kids can use a spring scale to measure the force of friction. )
- Use toy cars or a dynamic cart to test what impact increased mass has on velocity. What are the resulting velocities after a moving and unmoving object collide? What about two moving objects in same or different directions?
- What type of pulley provides the highest mechanical advantage for a particular job?
- What types of metal conduct heat the fastest? Do some conduct heat more evenly than others? What types of materials are good insulators?
- Experiment with how much more energy is needed to catapult a heavier object the same distance as a lighter object. Create a similar experiment with a bow and arrow.
- Explore centripetal force by designing and building a mini roller coaster and demonstrating the physics behind it.

### Energy:

- How does the efficiency of an incandescent bulb compare to a fluorescent? What about LED? How much heat energy do they produce?
- Compare the effectiveness of different types of insulation. Which keeps out the most heat or cold?

### Alternative Energy:

- How could you use a solar cell to recharge a battery? (You'll need to use a diode and set up a circuit.) How does a solar cell compare to a battery with the same voltage?
- How would you use solar energy most effectively in your home or school?
- What time of day tends to be best for charging a solar cell?
- How does the angle of incidence of light affect the energy output of a solar cell? Use a digital multimeter to measure how much voltage is being produced by the solar cell.
- What types of blades work best to produce electricity using a wind turbine?
- Can you create an effective water turbine design? How would you connect it to a generator to produce electricity?

- Can you test/simulate the environmental effects of producing electricity from steam in geothermal areas?
- Can different substances (such as vinegar or salt) be used in electrolysis to make hydrogen production more cost-effective?
- Does increasing the number of electrodes make the process of electrolysis less time consuming or more cost effective?
- Can different alternative energy sources be used in combination to produce the energy to power a home?