

Lesson 1 : Water Wheel [Engineering]

By: Eric & Alex Lee

Video : <https://www.youtube.com/watch?v=eifaKPnuiO4>

Vocabulary :

- Kinetic Energy - the energy of motion; equal to one half times mass times the square of the velocity of an object

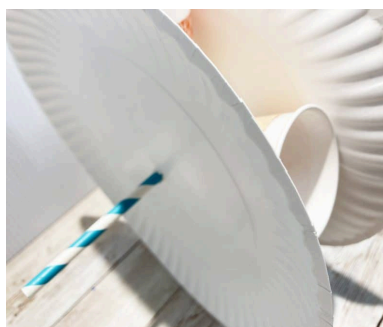
Materials :

- 2 Paper plates
- Straw
- Tape
- Small paper cups
- Scissors



Procedure :

- 1: Poke a hole in the center of both paper plates the size of your straw.
- 2: Tape four paper cups to the back of a paper plate, the hollow side facing out.
- 3: Tape the second plate to the other side of your paper cups. Then thread the straw through the holes you have made in the plates.
- 4: Check to make sure your cups can spin on the straw.
- 5: Hold your water wheel straw firmly under a slow stream of water in your sink and watch the action!



* Students learn how water is used to generate energy. They investigate water's potential-to-kinetic energy transformation in hands-on activities about waterwheels.

Show students the video and explain vocabulary words.

Pass out materials.

Lesson 2 : Walking Water [Chemistry]

By: Eric & Alex Lee

Video : <https://www.youtube.com/watch?v=s2Jud7F478I>

Vocabulary :

- capillary action - the process of a liquid flowing in a narrow space without the assistance of, or even in opposition to, any external forces like gravity.

Materials :

- 5 clear glass (like mason jars) or plastic cup
- Red, blue, and yellow food coloring
- Scissors
- 2 paper towels
- Water



Procedure :

- 1 : Place 5 cups in a row and pour water in the 1st, 3rd, and 5th (odd-numbered) cups. Fuller is better, so fill them about $\frac{3}{4}$ full.
- 2 : Add 3 drops of red food coloring to the 1st cup. Add 3 drops of blue food coloring to the 3rd cup. And 3 drops of yellow food coloring to the 5th cup.
- 3 : Take the paper towel half-sheet (you'll need 6 total) and fold it in half (lengthwise) and repeat the folding process until your paper towel strip is 1-2 inches wide.
- 4 : Trim off a bit of the length so that there isn't much excess paper towel that will stick up in the air between each cup. This will help the water move faster.
- 5 : Place one half of a rolled paper towel in the 1st cup and place the other half in the cup next to it (the empty 2nd cup). Then another paper towel from the 2nd cup and into the full 3rd cup.
- 6 : Watch the cups to find out what begins to happen. It shouldn't take long before you are able to see the colored water begin to travel up the paper towel.

* Students learn about the mixing of colors. But apart from that, the walking water experiment helps them learn about capillary action too. What is capillary action? In this experiment, you'll notice how the water moves up the paper towels along with the food dye molecules.

The adhesive force between the paper towel and the water are more powerful than the cohesive force inside the water itself. This results in the paper towel pulling the water up. The water keeps traveling up the paper towel, across the bridge and into the other cup.

Show students the video and explain vocabulary words.

Pass out materials.

Lesson 3 : Lemon Volcano [Chemical Reaction]

By: Eric & Alex Lee

Video : <https://www.youtube.com/watch?v=CPOKDru-2ug>

Vocabulary :

- Citric acid
- sodium bicarbonate
- carbon dioxide
- sodium citrate

Materials :

- Pan or tray
- Lemons
- Cutting knife
- Butter knife
- Spoon
- Baking soda
- Food coloring



Procedure :

- 1 : Have an adult cut the top and bottom off the lemon so it stands upright.
- 2 : Use a butter knife and spoon to break up/partially scoop out the inside of the lemon.
- 3 : Add a few drops of food coloring to the inside of the lemon.
- 4 : Pour some baking soda on top of the lemon.
- 5 : Use the butter knife to mix the baking soda with the inside of the lemon.
- 6 : Keep mixing with the knife periodically, and adding more baking soda, until the reaction stops.



* The erupting lemon volcano demonstrates the effects of mixing a base (baking soda) with an acid (lemon juice) to produce a gas (carbon dioxide). When the baking soda was added to the lemon juice, it bubbled and foamed. That is because when sodium bicarbonate (baking soda) and citric acid (lemon juice) are combined, they react by forming carbon dioxide gas as well as a chemical compound called sodium citrate. Show students the video and explain vocabulary words.

- Citric acid : an organic compound with the chemical formula $\text{HOC}(\text{CO}_2\text{H})_2$. It is a **colorless weak organic acid**. It occurs naturally in citrus fruits.
- **sodium bicarbonate** : commonly known as baking soda or bicarbonate of soda, is a chemical compound with the formula NaHCO_3 . It is a salt composed of a sodium cation and a bicarbonate anion. Sodium bicarbonate is a white solid that is crystalline, but often appears as a fine powder.
- **carbon dioxide** : a chemical compound made up of molecules that each have one carbon atom covalently double bonded to two oxygen atoms. It is found in the gas state at room temperature, and as the source of available carbon in the carbon cycle, atmospheric CO_2 is the primary carbon source for life on Earth.
- **sodium citrate** : the sodium salt of citric acid. Like citric acid, it has a sour taste. Like other salts, it also has a salty taste. It is commonly known as sour salt and is mainly used as a food additive, usually for flavor or as a preservative.

Pass out materials.

Lesson 4 : Moon Phases Craft [Earth Science]

By: Eric & Alex Lee

Video : <https://www.youtube.com/watch?v=Az5x8d5ZX5k>

Vocabulary :

- NEW MOON
- WAXING CRESCENT
- FIRST QUARTER
- WAXING GIBBOUS
- FULL MOON
- WANING GIBBOUS
- LAST QUARTER
- WANING CRESCENT

Materials :

- Oreo cookies or similar generic brand
- Paper plate
- Marker
- Plastic knife, fork, or spoon (for carving out the moon phases)



Procedure :

- 1: Open up a pack of cookies and twist eight cookies carefully apart.
- 2: Use the edge of a fork to draw a line down the center of the icing, carefully scrape off half the icing, and set it onto the top of the paper plate to begin your first quarter Moon cycle.
- 3: Work from left to right on your cookie moon cycle, with the next being waxing gibbous. Use the fork to draw the line, scrape off the icing, and set on the left of the first quarter Moon.
- 4: Work your way around: full Moon, waning gibbous, third quarter, waning crescent, new moon, waning crescent, and back to the first quarter.
- 5: Once all the Oreo Moon's are on the plate in a circle, carefully draw the Earth in the center with markers.
- 6: Use a marker or pen to write which Moon phase each cookie represents next to the appropriate Moon cookie model.

* The phases of the moon are called phases for a reason. Because of its rotation and position, the moon never looks the same and is constantly entering a different stage. Let the moon's fickleness serve as a reminder of life's changing nature.

Show students the video and explain vocabulary words.

Pass out materials.

Lesson 5 :Paper Airplane Designs [Aerodynamics]

By: Eric & Alex Lee

"Which one flies the furthest?"

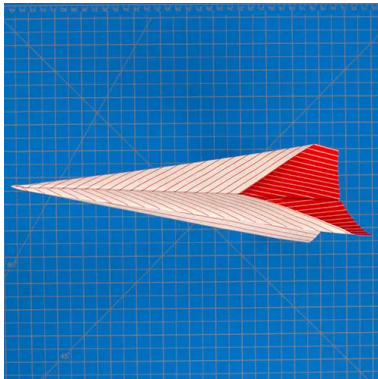
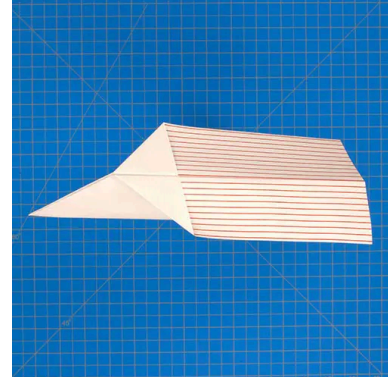
Vocabulary : thrust, drag, lift and gravity

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The Basic

Video :

<https://youtu.be/u-HKNkao6i0>



Basic Dart

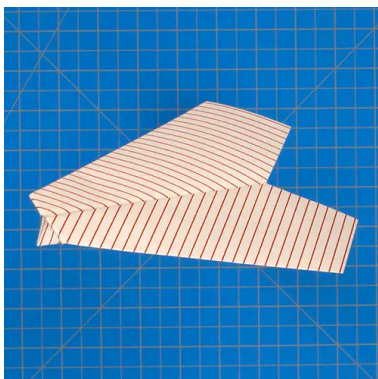
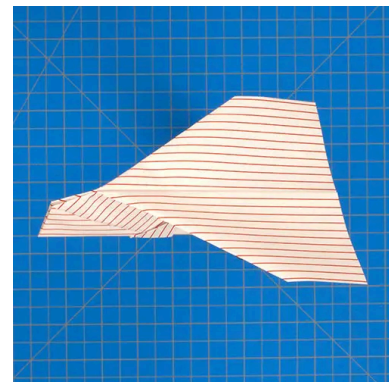
Video :

https://youtu.be/gZQl1Z_vINg

The Stable

Video :

<https://youtu.be/QbDUiGmxQIQ>



The Buzz

Video :

<https://youtu.be/WB6NornyZc4>

* When you push a paper airplane forward (or any airplane for that matter), this is a type of force known as thrust. Meanwhile, air is pushing back on the plane, which is called drag. While a plane is flying, air moving over and under the wings pushing it upward, while the gravity from the Earth pulls it down.

Explain vocabulary words and show students the video to follow the instruction.

The Basic

The most basic design that almost everyone has tried.

It's quick and easy to make, and it flies fairly well. This paper airplane is a little floppy, so it works better if you give it a gentle toss, not a hard throw. A good starter airplane for young kids.

Basic Dart

A basic design with decent distance and speed.

This is one of the most iconic paper airplane designs, and also one of the easiest to fold. It flies very fast, in a nice straight line. A forgiving airplane design that works well even with uneven or asymmetrical folds. The perfect starter airplane for anyone just learning.

The Stable

This paper airplane has a lot of stability and can fly for a long time.

It likes to fly in big wide loops. If you slightly bend up the two flaps at the rear, you can get it to do flips and tricks.

The Buzz

This paper plane looks like a fly and it flies like one too!

Bend the tail flaps up or down to control the flight. Bend one up and one down to make it spiral!