THIS IS ROCKET SCIENCE

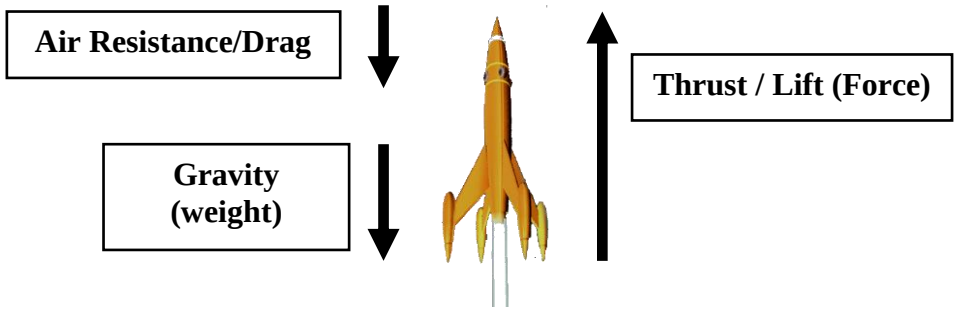
Purpose:

To create an air/powered rocket using paper and tape that is designed to obtain maximum height and velocity once launched.

Background Information: (please read BEFORE starting)

Humans, since early in our history, have looked to the skies above and wondered what lay beyond this world. The biggest obstacle humans have faced is Earth's **gravity**. **Yes, gravity.** Earth's gravity keeps pulling us down at 9.8m/s^2 (32 ft/s^2). When we jump up, we always seem to fall right back down to Earth (3rd Law – action/reaction). It was not until someone figured out that we needed to generate a larger force (thrust) to overcome gravity and allow us to emancipate (free) ourselves from Earth's gravitational attractive force.

When a rocket is launched there are many forces that act on it as it moves through the air. Look at the force diagram below to see where the forces are directed and the magnitude (size) of the forces.



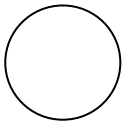
Newton's Laws of Motion help to explain a rocket in flight. First law states that rockets will stay in motion until acted on by an outside force (this is Inertia). The outside forces acting on your rocket are gravity and air resistance. If your rocket was able to reach the escape velocity on Earth (~25,000 mph) it would keep traveling forever in space (unless it hit a planet, asteroid or entered another gravitational field)

Fuselage (Rocket Body):

1.) Select one piece of paper to be the fuselage of your rocket
2.) Roll it up around the PVC pipe
3.) VERY IMPORTANT: Make sure it is not **too tight** or it will explode during launch. Make sure there is a **little space** between the paper and the PVC pipe when you roll it. (**TEST ON THE LAUNCHER TO SEE IF IT WORKS**)
4.) Use tape (DON'T BE A TAPE WASTER) to secure the fuselage
5.) Write your names on it and give your rocket a name (**BIG LETTERS**).

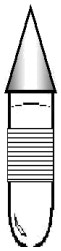
Pressure Cap:

The pressure cap helps keep the air pressure inside the fuselage. It helps prevent air from escaping out the nose cone. It seems as if the pressure cap is not big deal. **Well, it is**! If you want your rocket to *rocket* into the sky, make sure you include the pressure cap and it is taped in place to avoid air escaping.



Nosecone:

The purpose of the nosecone is to make the rocket **more aerodynamic** (reduce air resistance/drag during flight) and to **house your parachute** (however we will not be using parachutes in our rockets this time around). You are welcome to try different nosecones (length, volume, shape) to see how changing it affects your rocket. Make sure the nosecone points straight up.

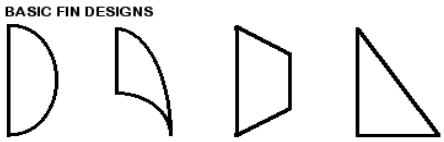


Mass of Rocket:

There is a fine balance between a rocket that has too little and one that has too much mass. Too little mass means the rocket has less **kinetic energy**, **inertia** and **momentum** during flight. Air seems to have a significant impact on the flight of the rocket, especially one that has little mass. A more massive rocket will better able to move through the air due to its greater kinetic energy and inertia. The flip side is that more mass means more force needed to accelerate the rocket (f=ma, Newton's 2nd Law of Motion). By adding a counter weight (c.w.) to the rocket (in the nosecone) the amount of force applied by the rocket increases so it can overcome some of the force generated by the air on the rocket.

Fins:

Fins help to **stabilize** your rocket. Without them your rocket would tumble and spin out of control once it left the launch pad.



Designs:

To ensure stability and safety, the **minimum number of fins** on a rocket is **three (3)**. Many people choose a 3 or 4 (or more) fin design. There is **no maximum** number of fins you may have, but keep in mind that the **more fins** you have the **more drag (air friction)** you will create. This decreases the efficiency of your rocket.

Placement of Fins on the Fuselage:

You want to **place your fins** so you have the **lowest possible center of gravity**. If you were to place the fins above the center of gravity, the rocket would tumble and spin out of control (which is not good rocket science). Research this online for optimal fin placement and design.

1. **Choose** a design and cut it out of paper (trace the other fins using the first fin as a model).
2. Bend a tab on the root edge of each fin. **Trace** the fin base placement onto the bottle. (make it as **vertical** and as **straight** as possible).
3. Use tape to attach each fin. Don't waste the tape.