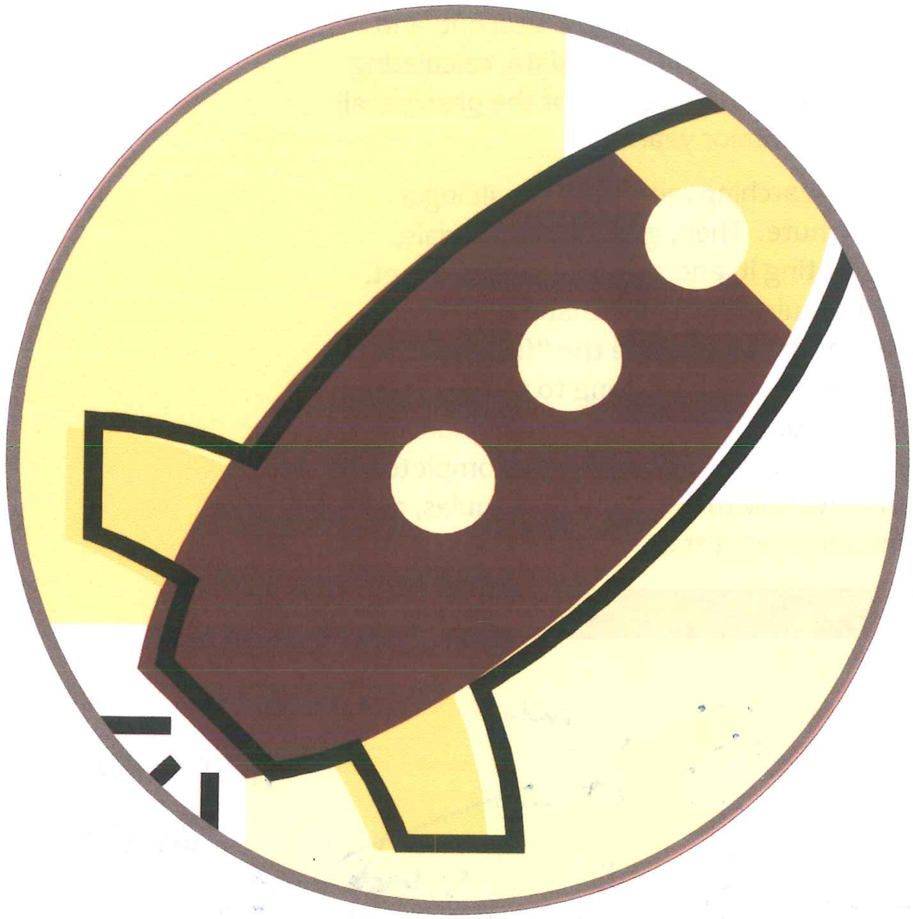

2L Bottle Rocket Project

By:

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Physics
Konichek 7th Hour

PURPOSE & PROCEDURE

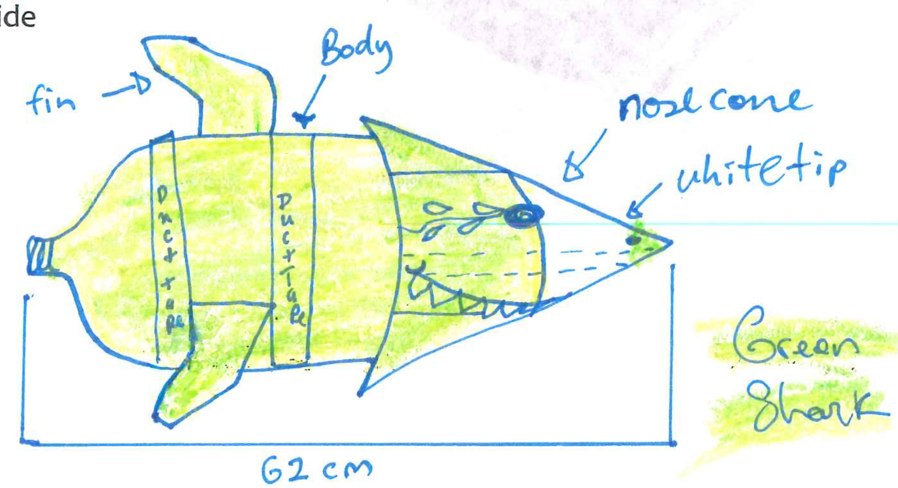
The purpose of the final is to use physics knowledge to build an aerodynamic rocket that allows for a fast launch, slow descent, and ensures the survival of an "eggstronaut". Collecting data, calculating velocity, force, acceleration and height must be part of the process: all while enjoying the last sunny days of junior year.

The procedure included researching methods of building a water rocket, fuselage, and parachute. Then, gathering materials, constructing the structure, decorating it, and assembling the rocket. After that, launching the rocket required a leak-free launch pad to rocket connection, less than a liter of water inside the "fuel tank", a pump, a handful of classmates (and teachers) willing to time the up and total times; measure the angle of height, distance from launch pad, and record the event on camera. Last, assembling a complete report required solving for unknowns with law abiding formulas, and recorded data for calculations collected at the launch.

DESIGN

Top

Side



APPEARANCE

The rocket was constructed to resemble the shape of a shark. The color scheme contained green hues and white. I named my rocket the Green Shark because I thought if a shark could fly, maybe humans could be more "green" and take care of the Earth's ecosystems better and prolong existence of life on this planet.

DATA

Initial Mass: 259g

Time up: 2.075 seconds

Total time of egg capsule: 4.15 seconds

Angle: 22.5 at 41 paces

Length of rocket: .62 meters

Rocket acceleration: 2 meters/second^2

Solve for a by using Fab five #4 $\Delta S = Vi\Delta + .5\,a\Delta t^2 \quad = .5at^2$

Used examples on webpage and calculated frames per second to be 65.3. (in proportion to Radida's and considering she also used 5 atm. of pressure) this means the time is .0653 because the camera has a 1000 FPS. Considering we have the rocket height we can now plug in to the formula above.

$.62m = (.5)a(.0653sec)$

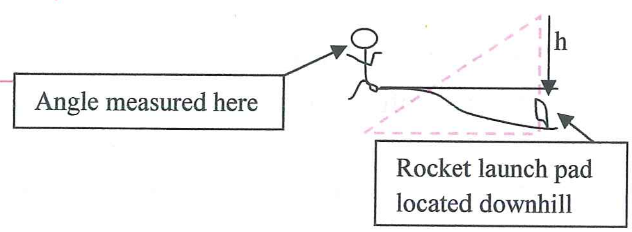
$a = ((2*.62m)/.0653sec^2)$

$a = 290.8\ m/s^2$ Sig figs= ~~2~~ 300 m/s^2

PERFORMANCE

1. *The egg did not survive.*
2. *Performance value was below standard. 1 point awarded for time up.*

CALCULATIONS



Max. Height: 2 methods shown

- Via Vertical Triangulation

Eye height (m)	Pace (m)	# of paces	Total distance b (m)	Angle 1 c	Angle 2	Height= $b(\sin\Theta_1 * \sin\Theta_2 / \sin(\Theta_1 - \Theta_2))$ + e
1.58	.050 m per pace	41	2.05 meters	40	22.5	H= 2.05m ((sin 40*sin22.5)/(sin(40-22.5)+1.58= 3.25m

- Via Fab Five #4

$\Delta S= .5(a)\ t^2$

$\Delta S= .5\ (9.8gs)\ (2.075sec)^2$

$\Delta S=$ 20.45 meters ← this number seems the most accurate and will be used for the remainder of calculations

Max. Velocity of rocket: via Fab Five

V= square root(2*g*S)

V= square root(2(9.8)20.45)

V=20.02 m/s

Force acting on the rocket:

F= m*a

F= .259Kg * 290.8 m/s^2

F= 75.3172 N of FORCE

CONCLUSION & SUMMARY

I expected my rocket to work. I was surprise the parachute had ONE JOB and it failed. The rocket cone and body separated beautifully in the air, the colors of the paint shone like a morning star against a blue sky. But, since the parachute's attachments to the cone could not withstand the force of the launch, the cone fell to the ground without anything slowing it down. The egg compartment could not withstand the force of a full-blown impact and shattered. I would duct tape the parachute to the cone in the future to prevent any detachment from the cone. To deliver the egg compartment safely to the ground, I would reinforce it by adding a hamster ball casing. Then, I would stuff a back up parachute in the fuselage before launching again. All calculations seemed reasonable except for the vertical triangulation challenge calculation. I realized I had underestimated the force all components must withstand. Mass and length of the rocket made it travel far. The weight of the rocket compared to other rockets around the classroom measured significantly less. The length of my rocket was also smaller than many of the others around the classroom. Overall, it was a good PHYSICS moment.