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Abstract: An experiment to find how wind speed affects the altitude. Instruments such as an anemometer, theodolites with horizontal and just normal string will be used.

Purpose:

To test the altitude with every 100 feet of string to see how wind speed affects the altitude of the balloon.

Equipment:

1 six foot diameter weather balloon
1000 feet of string
String base
2 theodolites with horizontal

Anemometer
Measuring tape
Pencil
Paper
Clipboard
Vernier Logger Pro
Barometer
Stopwatch
Walkie-talkies
Laptop

Method:

With a balloon (6 feet diameter), 1000 feet of string, an anemometer, two (2) theodolites, we will find the effect of wind speed on altitude. To test the wind speed, we will use the anemometer; and to find the altitude, we will measure out 100 feet of string and then test the wind speed.

Prediction:

We expect to see the altitude of the balloon decrease with increase of wind speed. We also expect to prove or disprove our hypotheses.

Hypotheses:

1. The higher the wind speed, the lower the altitude of the balloon.

2. As the balloon elevates every 100 ft. of string, the altitude's lift consistency will depreciate due to the increase of string mass along with the payload of the gondola

3. The more volume that the balloon has, the more lift the balloon will have, causing it to fly higher.

Test:

1. Altitude will be measured five times every 100 ft of string and will be recorded with a time, so later we can compare it to wind speed.

2. The mass of the balloon, string, gondola, and other tools will be measured to see how the mass affects the altitude.

3. The volume of the balloon will determine how much excess lift that the balloon has, which we will calculate.

Research:

Assuming constant temperature: PV = constant

$$\Delta P = \frac{V}{1.43\,ft^3} 14.7 \frac{psi}{ft^3}$$

Every 10 ft^3 will use up about 103 psi for this size cylinder.

Flight String

150 #-test braided nylon twine
weighs 350g / 1000ft:
$\mu = 0.350$ g/ft (9.8N/1000g) = 0.0034 N/ft
$F_w = \mu L$

Drag

$F_d = \frac{1}{2} C_d \rho V^2 A$
C_d = coefficient of drag ≈ 0.5
ρ = density of air = 1.23 kg/m^3
V = air speed (1 knot = 0.514 m/s)
A = cross sectional area = πr^2
$F_d = \frac{1}{2} C_d \rho \pi V^2 (0.514\text{m/s/knot})^2 r^2 (1\text{m}/3.28\text{ft})^2$
$= k_1 V^2 r^2$
$k_1 = 0.23$ N/(knot ft)^2