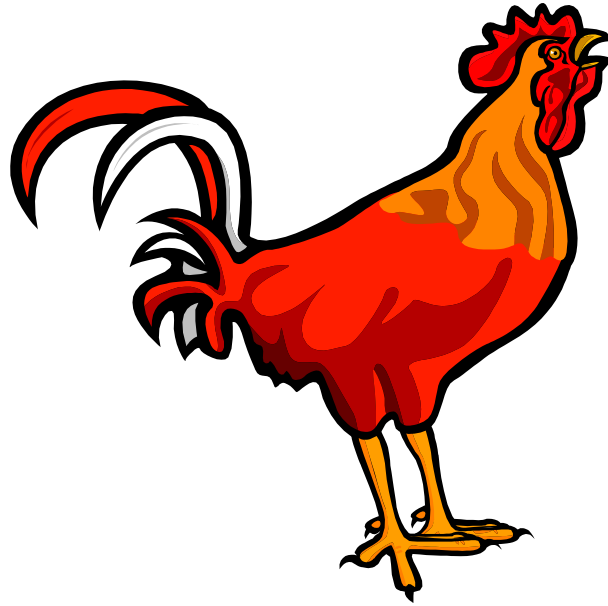


Black Hawk



# Experiment Design

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## Purpose

To measure the barometric pressure on the ground and then compare it to the air pressure in the atmosphere. Then take the temperature on the ground and then compare the temperature in the atmosphere at 1,000ft.

## Equipment:

- 2 barometers
- 2 thermometers
- 2 Veriner Lab Pros
- 1 Balloon
- Helium
- 1000ft of Dacron cord
- Stopwatch
- Pen/pencils
- Gondola cord

## Payload:

1. 1 barometer
2. 1 thermometer
3. 1 Lab Pro

## Data Pro Settings

Ch1-thermometer

Ch2-barometer

2 seconds/sample

2101 samples

4200 seconds (70 minutes)

**Time Divider** (This is how we will divide up the flight time).

100 ft = ~ 120second (2 minutes)

Hold 150 second (2.5 minutes)/100ft x 10 = 1500 seconds

At top hold 5 minutes (300 seconds)

Time on the way down = 1200 seconds

Total Time = 4200 seconds (70 minutes)

## Weight

1240g

## **Flight Procedure**

- Fill the balloon with helium until the balloon will lift 1.5kg more than the payload of the gondola. To measure this the diameter of the balloon should be around 6.3ft.
- Tie the balloon and then attach the metal ring.
- Then attach the gondola to the metal ring.
- Start the written log; write down the air pressure and temperature at ground level.
- Start the Lab Pro on the gondola and also the one on the ground, and then start the stopwatch and the written log about the same time.
- Launch balloon and let it rise to a height of 100 ft or 30m (this should take about 2 minutes).
- Hold for 150 seconds at 100ft and then repeat until a height of 1000ft is reached.
- Tie a red flag at every 100ft until 1000ft is reached.
- Take angle measure when 100ft line is let out.
- Hold at top for 5 minutes
- Start to bring it down; this should take about 5 minutes.
- As soon as the balloon is taken down we'll:
  - Stop the data collection
  - Measure and record barometric pressure and temperature at ground level.
  - Save the data.
  - If needed, restart and do it again.

## **Data Analysis Procedure:**

When all flight test are done:

- Be sure last data set is saved.
- Quit Data Pro.
- Disconnect the Palm PDA.

Transfer data to the computer

- Connect the Palm cradle to the USB port.
- Synchronize the palm on the computer; this transfers the data as a text file into the \Palm\data folder.

Analyze the data in the graphical analysis program

- Open Graphical Analysis and “import from text file”
- Add a new calculation column named “altitude”
- Formula:  $-10 \cdot (\text{Barometer} - \max(\text{Barometer}))$
- If the barometer is in psi then use  $0.193$  for meters or  $-64$  for ft
- Graph#1: Altitude vs. time
- Graph#2: Temperature vs. time
- Graph#3 Temperature vs. altitude
- Graph#4 Air pressure vs. time
- Graph#5 Air pressure vs. altitude

### Experimental Info(on the ground):

Altitude (ft)	Feet of String out(ft)	Barometer (psi)	Temperature(C°)
0	0		
100	100		
200	200		
300	300		
400	400		
500	500		
600	600		
700	700		
800	800		
900	900		
1000	1000		

### Experiment Info:

Time(sec)	Altitude(ft)	Barometer (psi)	Temperature(C°)
0			
420			
840			
1260			
1680			
2100			
2520			
2940			
3360			
3780			
4200			

<b>Time mm:ss</b>		<b>What Happened</b>	<b>Angle of Balloon</b>	<b>Temp (°C)</b>	<b>Line Out (ft)</b>
12	02	<u>Launch/hit start button/start time (rough start, wind)</u>	70°		0
12	04	<u>First 100 ft (stopped for 2:00 min) (calm)</u>	70°		100
12	08	<u>At 200 ft (calm)</u>	62°		200
12	12	<u>At 300 ft (calm)</u>	66°		300
12	16	<u>At 400 ft (slight wind)</u>	46°		400
12	20	<u>At 500 ft (calm)</u>	66°		500
12	24	<u>At 600 ft (calm)</u>	56°		600
12	28	<u>At 700 ft (calm)</u>	62°		700
12	32	<u>At 800 ft (slight wind)</u>	54°		800
12	36	<u>At 900 ft (slight wind)</u>			900
12	45	<u>Balloon at peak (5 minute wait period)/(4 minute delay)/(no wind)</u>			
12	52	<u>Completed decent (20 minutes)</u>			

## **Procedure**

1. At the 2 minute mark the balloon should have been at an altitude of about 100ft (30meters) and should have been held at that altitude for a minimum of 150 seconds.
2. This should have been repeated until a maximum height of 1000ft was reached.
3. After the balloon reached a 1000ft the balloon should have been held for 5 minutes to gain an accurate measurement at 1000ft.
4. The angle measure should have been taken every time 100ft of line was let out to get the altitude of the balloon.
5. Then the balloon would have been pulled in at a constant rate.
6. Then record the data of the Lab Pro.