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Mechatronics

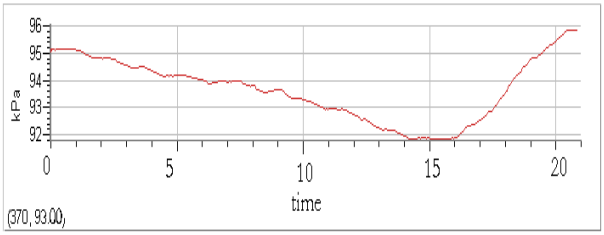
Purpose of the Experiment:

The purpose of our experiment was to measure changes in atmospheric pressure over time and altitude compared to a calculated altitude using a barometer. We compared a measured altitude to atmospheric models to see which was more accurate.

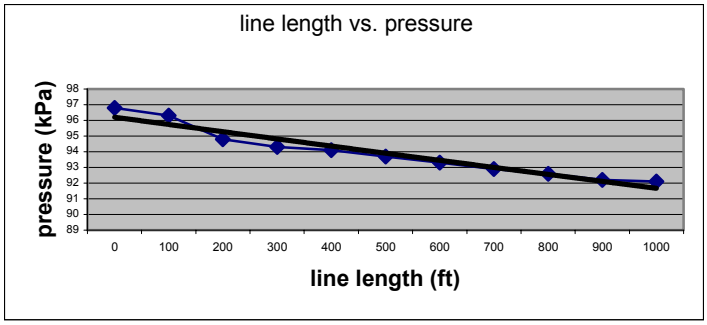
Source and Origin of Data:

Our data was collected during Balloonfest. A barometer in a gondola tethered to the balloon was used to measure the atmospheric pressure with time. We used our balloon's line length as the measured altitude in our experiment. To calculate the altitude with a barometer, we used the meteorological atmospheric standard formula (P0e^(-h/26185.5ft) to find the altitude.

Data and Graphs:



The highest point of the balloon, or 1000 ft. of line, is at 15 minutes and after that is the reeling in process The time displays 20 minutes with 1000 ft. of line and decreases at an avg. slope of -0.002217 kPa/min. The slope is irregular do to 2 minute stops when 100ft of line was let out and a ribbon attached and uneven reeling out.



This the theorized line fit composed by the computer. (Black line)
The blue line is the raw data.

Hypotheses/Tests:

Hypothesis A:

We can use the barometer to accurately calculate the balloon's altitude. We shall use the atmospheric pressure formula do this.

Test 1: The altitude graph should go up then down
Test 2: The ending altitude should be the same as the beginning altitude
Test 3: The calculated altitude should be the same as the measured altitude
Test 4: Changes in altitude should match the descriptions in log

Test Results:

Test 1: The altitude rise and fell with the change of pressure
Test 2: The ending altitude was actually lower than the starting altitude
Test 3: The calculated altitude was not the same as the measured altitude (± 400ft)
Test 4: Altitude changes matched descriptions on log.

Test Conclusion: There are many possible reasons for these results. Our calculations could be wrong or equations faulty. Wind could cause irregular changes in altitude. Also air pressure changed during the day. This hypothesis proved false because of the irregular number given by the calculated altitude.

Hypothesis B:

Wind blowing into the barometer or through the gondola can result in a change of accuracy in the altitude and air pressure readings.

Test 1: Blow into the barometer while it is attached to the computer and see if it drastically changes the results of air pressure.
Test 2: Shake the entire gondola while it is attached to the computer with enough slack for movement and see if the data samples are completely different or relatively close to the norm.
Test 3: Any times where wind speed was over regular knot amounts must be recorded on the log for future reference and should match up, time wise, with the data samples.

Test Results:

Test 1: Air pressure changed drastically. (about an increase or 2 or 3 kpa)
Test 2: Minimal or no changes.
Test 3: Changes in wind speed were recorded

Test Conclusion: If there is no wind, then you can't see if there is a change. This hypothesis proved to be plausible but still needed more tests to come to a conclusion.

Revised Hypotheses/tests:

Hypothesis A:

We used the barometer and labpro with the logger pro program to accurately measure the air pressure. We then can then use the meteorological standard atmosphere formula to find the altitude at which the air pressure was found.

Test 1: Altitude should read zero in the calculated column when the gondola, or barometer and labpro, is at ground level.
Test 2:

Hypothesis B:

Wind being blown into the barometer through the gondola cannot result I a change in air pressure, or the change is extremely low.

Test 1: Blow as hard as possible into the barometer while it's attached to the computer and with the logger pro program open and see if there is any changes.
Test 2: Set up the barometer and lab pro for remote data and ride in or on a vehicle and see if there is a change in air pressure

Conclusion: Our purpose was to measure atmospheric pressure over time and altitude compared to a calculated altitude using a barometer. This purpose was completed although there were bogus numbers. We found that the measured altitude was more accurate than calculating altitude with a barometer.