



Date: Friday, April 24, 2009

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Period: 4

The Four Horsemen

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Balloon Fest VALIDATION



Abstract:

This document contains the Balloon Fest Validation of The Four Horsemen. The validation has: the description of our experiment, the equipment to be tested, our research, test plan, data, analysis, and our conclusion.



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The Four Horsemen Balloon Fest Equipment Validation

Description of Experiment:

The atmospheric pressure and temperature varies with altitude. Can we predictably and accurately measure the altitude by sensing the pressure and the temperature?

Equipment to be Tested:

We plan to use a Vernier Barometer sensor and Vernier SS Temperature Probe with a LabPro. The LabPro will be programmed with a laptop computer running Logger Pro software. Data will be collected remotely and then downloaded into Logger Pro for analysis.

Research (specifications and expected values):

The Barometer Spec sheet (available on the <http://www.vernier.com> Website) provides the following information:

- Pressure Range (as shipped): 0.8 to 1.05 atm (25 to 31.5 in Hg) - Maximum Pressure that the sensor can tolerate without permanent damage: 30 psi or 61 in Hg or 207 kPa - Sensitivity: 436 mV/in Hg or 13.06 V/atm - Resolution (as shipped) using a 12-bit, 5 volt A/D converter: 0.003 in HG - Resolution (as shipped) using a 10-bit, 5-volt A/D converter: 0.01 in Hg - Combined linearity and hysteresis: typical +/-0.1% full scale, maximum +/-0.5% full scale - Response Time: 100 microseconds

We should expect that the pressure will vary from ... to ... due to typical weather and it should decrease by about 113 kPa as the balloon rises from ground level to 1000 ft elevation.

The Temperature is expected to vary from ... to ... over the course of the morning and is expected to drop by 6.5 K as the elevation increases to 1000 ft. The Atmospheric Research Website states that we should expect that 54.5 m of elevation will cause a 1 kPa change in pressure.

Data:

Info from the sheet gave us our analysis. We also took two tests, which gave us more info.

Analysis:

From analysis of the data, we calculate the resolution of this equipment is 0.02 kPa and the precision is ± 0.04 kPa.

Repeated measurements of the same situation commonly vary over this range.

The sensor is accurate within ± 2 kPa or about 2%.

Conclusion:

This means that we should be able to use the sensor to measure altitude with an uncertainty of ± 2 m ($0.04 \text{ kPa} \times 54.5 \text{ m/kPa}$).