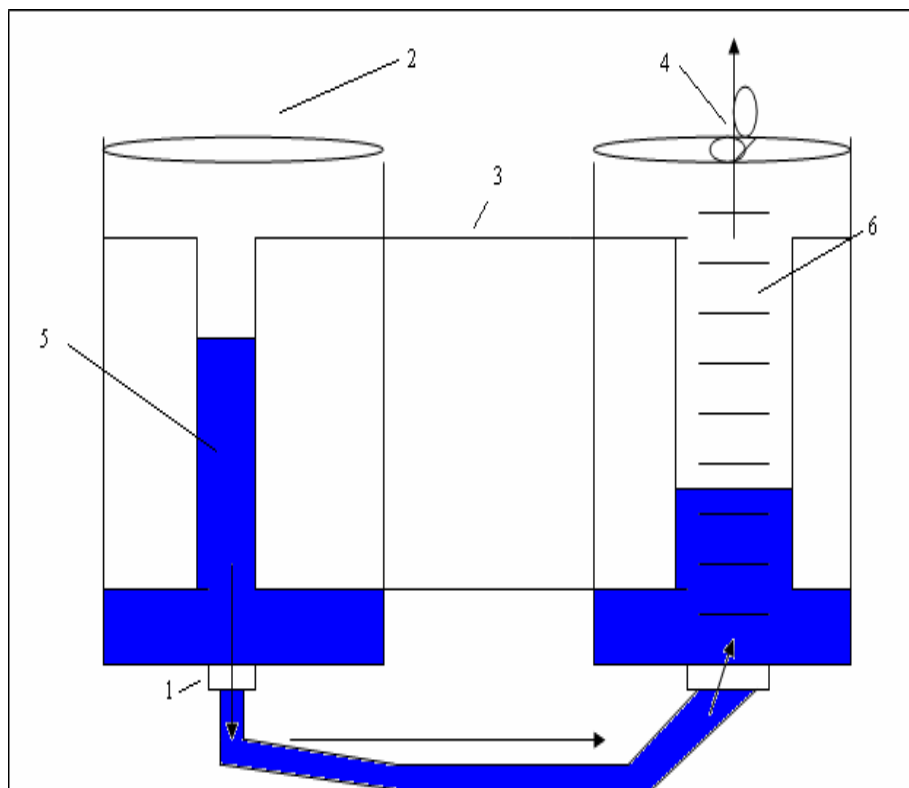


# Balloon Fest 2007

6-8-07

## MS-ERAH

Measuring System for the Expansion Rate of Air with Height.



Not to scale

Measuring the expansion rate of air with height.

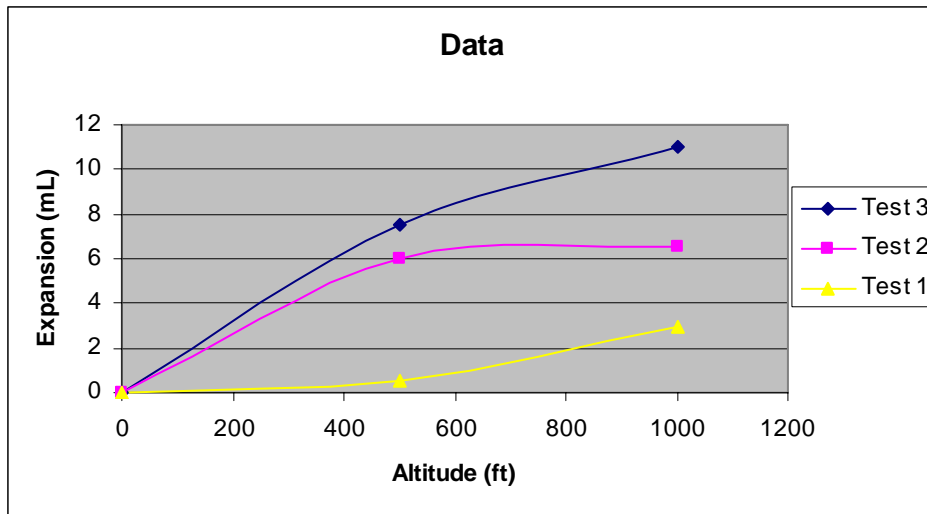
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### Purpose of this experiment

The purpose of our experiment was to determine how much air pressure is affected by altitude. We measured how much air expanded inside an apparatus as it increased in altitude. The balloon was let out to 600 and 1000 ft three times each. In two hours we conducted six tests. Our gondola weighed about a kilogram. Using this we then tested the design to prove whether our hypothesis was right or wrong.

### Source and Origin of Data

A team of five (5) students of the Endeavor Academy was assigned to work on the annual Balloon Fest. We formed a group and then decided to measure the expansion rate of air with altitude. We had no conventional equipment at our disposal to measure this, so we ended up building our own equipment. This took quite a bit of thinking to design and get working, when we got it working it proved to be the source of our data. With this and a rangefinder to verify the height we recorded our data.



Our graph shows the expansion of air over altitude. The different colored lines represent each test: yellow was the first trial, the pink was the second trial, and the third trial was blue. The lines first section measured 500ft and the second section measured 1000ft what was graphed was the results of each individual test.

The first two trials were not our most accurate measurements. On trail one the water in the second tank evaporated and we were unable to record the water measurements. On the second trial our main water tank began to leak, resulting in inaccurate measurements. Also we reused previously expanded air and that air won't expand any more.

## Hypothesis

We believe that we can measure air expansion by our equipment.

Our initial water level, of tank one, should rise because of air expansion. And this could be tested by sending our equipment up to different altitudes i.e. 500 and 1000ft. in our gondola. The water displaced by the expanded air should travel into the second tube through the tube to be measured. By each team member recording the water volume of the second tank after sending the tanks to the required heights we can directly relate the volumes to record. NOTE: The water should only travel *one* way through the tube. If it the water flows both ways, then the displaced water would reenter the first tank and can't be measured. Our original design for our equipment failed because it did not keep the water in the second tank. From our calculations we expected the air to expand to the volume of eleven ml. By further calculating our lift and weight we learned that the new amount of expanded air was to be twenty two ml.

## MS-ERAH Conclusion

Even with the many problems involved with our experiment, we believe our last test was able to measure expansion of air fairly accurately. We believe that our apparatus was working properly and it only took a certain amount of force to push water through our one-way valve, and therefore, not showing the correct amount of water because not enough water could go through. From our experiment we found that the expansion of air with 1000 ft was around 11ml. Compared to our predictions this measurement was quite

different from the expected twenty-two ml, however our measurements from 500 to 1000ft was proportional to our predicted amount. Our experiment was a success and the team worked hard to accomplish this.