Absolut Zero Lab

If gases expand as they are heated, it stands to reason that they would contract as they cool.

As you continue to lower the temperature the volume should continue to shrink. The lowest possible volume should be zero, and so the lowest temperature should be that that causes the volume to be zero. Of course, in reality the volume of a gas can never be reduced to zero, as the molecules themselves have some volume.

Materials

*All the glass materials must be made of some sort of Pyrex-like material, to prevent shattering during temperature changes.*

* Ice
* Water
* 125 mL Erlenmeyer flask
* 1000mL Beaker
* One or Two-hole rubber stopper that fits the 125 mL flask
* Ring stand
* Hot plate
* Tongs big enough to hold the 125 mL flask
* Celsius thermometer
* Graduated cylinder

Procedure

1. Make 4 water baths at 4 different temperatures, one of which is 100oC.
2. Put the one or two hole stopper into the dry 125 mL flask.
3. Hold the 125 mL flask upright so that most of flask is submerged in the boiling water bath. Continue to hold the flask submerged for about 5 minutes.
4. Record the temperature of the boiling water (which should be the same as that of the gas inside the flask). The more precise your measurements are, the more precise your determination of absolute zero will be.
5. Using the tongs, remove the flask from the hot bath.
6. Invert the Erlenmeyer flask and quickly place into one of the other water baths.
7. Making sure the flask is underwater, remove the glass rod in the stopper.
8. Keep the flask submerged in the ice bath for 6-7 minutes, stirring the ice bath occasionally. Water should creep inside the flask. *Why*?
9. Using your fingers, which might get chilly, raise the inverted flask until the water level inside and outside the flask are the same. This is to ensure that the pressure inside the flask is equal to atmospheric pressure. The only variable you want in this experiment is temperature.
10. Measure the temperature of the water in the ice bath.
11. Cover the holes in the stopper and remove the flask from the water and set it upright.

Data and Observations

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| --- | --- |
| Temperature in Celsius | Volume of gas in mL |
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Results

The expected value for absolute zero is -273.15 C. Find your absolute error and your percent error. Discuss any sources of error or changes to the experimental procedure that would yield more consistent results.