Physics Lab #1
Kris Wong 12TB

Data Analysis

According to Physics: Principles with Applications, the value of 0 Kelvin is -273.15 °C. It also states that Volume/Temperature is constant (Charles Law).

Mathematically

Calculation of errors:

$\theta_0 = V_0/[(V_{80}-V_{25})/(80-25)]$
Maximum % error in Intercept on volume axis = 0.05/24.9 = 0.2%
Maximum % error in volume change = 2*0.05/(32.0-27.2) = 2.1%
Maximum % error in temperature change = 2*0.2/(80-25) = 0.7%
Maximum % error in Intercept on temperature axis = 0.2% + 2.1% + 0.7% = 3.0%
Maximum error in Intercept on temperature axis = 3.0% *283.3 = 8.5

Calculation of Kelvin:

According to Charles Law, Volume/Temperature should be constant
According to the formula generated from the line of best fit on the graph:
Volume (ml) = 0.0875 Temperature (°C) + 24.966
Temperature = [Volume - 24.966] *11.429
= [0-24.966] *11.429(°C)
= - 285.3 (°C)
0 Volume is reached at 0 Kelvin, Therefore 0 Kelvin = -285.3 ± 8.5 (°C)

Graphically

Plotting of errors:

From the slope lines on graph 1.4,
Maximum % error in gradient = (0.0893-0.0842)/0.0842 = 5.6%
Maximum % error in Intercept on temperature axis = 5.6%
Maximum error in Intercept on temperature axis = 5.6% *287.3 = 16.1

Extrapolation of Kelvin:

From graph 1.5, the intercept on the temperature axis is at -287.3
0 Volume is reached at 0 Kelvin, Therefore 0 Kelvin = -287.3 ± 16.1 (°C)

Evaluation

Results:
According to Physics: Principles with Applications, the value of 0 Kelvin is -273.15 °C
From the results of the experiment, we can see that the range calculated mathematically does not include this value while the range shown by the graph does fall in this range.

Conclusion:
From the results, it is clear that volume and temperature (°C) have a linear relationship. According to Physics: Principles with Applications, V/T (when T is measured in Kelvin) is constant; therefore volume and temperature have a directly proportional relationship.
The graphical method has a larger range and is less precise as it is more prone to error than the mathematical method. According to the experiment we performed, using mathematical methods, 0K should be -285.3 ± 8.5 (°C). This range however, does not include the value of -273.15 °C, which indicates that the results we have obtained may not be very accurate, due to a number of reasons which are explained in the next section.

Problems encountered:
During the experiment, there were a few problems that we encountered. Firstly we were not able to place a thermometer directly in the gas and had to measure the temperature of the water surrounding the gas, which may have had different temperatures. Secondly, a layer of fog built up around the beaker as the temperature rose which made it quite difficult to get a correct reading of the temperature and the volume of the gas. Lastly, some of the water evaporated as we got near the 80 °C mark, which meant that the gas was not entirely submerged in the water, which may have caused an error in the measurement of temperature.

Suggested improvements:
The thermometer could be raised and clamped to ensure that all readings above 35°C - the temperature at which fog begins to appear - will be above the beaker and thus not above the fog.
This will also allow the thermometer to be placed closer to the gas, which means that the chance of error should be reduced. A larger beaker could ensure that the gas is submerged in the water all the way through which will mean that the temperature of the gas will be closer to the temperature of the water.