Lab #1
Boiling Point of Water

Objective

To determine the boiling point of water.

Introduction

Kinetic theory states that all molecules in matter are in constant motion (Kane and Sternheim, 1984). As these molecules absorb more energy they have a higher amount of random movement. As energy is absorbed in the form of heat the average kinetic energy (temperature) of the molecules will increase except during a phase change. The absorbed energy used in the phase change breaks the attractive forces between the molecules, thus transformation occurs in the orientation of the molecules. An example of a phase change would be the boiling point of water which is a change from a liquid to a gas. This can be observed by using a temperature versus time line graph when the slope becomes zero (plateau) The boiling point of water is expected to be 100.00 ºC (Merck, 1976).

Materials

500 ml beaker, distilled water, thermometer, hot plate, Word Perfect 11.1

Procedure

The required materials were selected and taken to the workstation. The beaker was filled with approximately 300 ml of distilled water. The beaker was gently placed on the hotplate. The thermometer was placed in the beaker and the initial temperature was recorded. The hotplate was switched on to high. The temperature was recorded every 2 minutes until 6 minutes after boiling began. The hotplate was turned off and the materials were allowed to cool for at least 10 minutes before the equipment was dismantled.

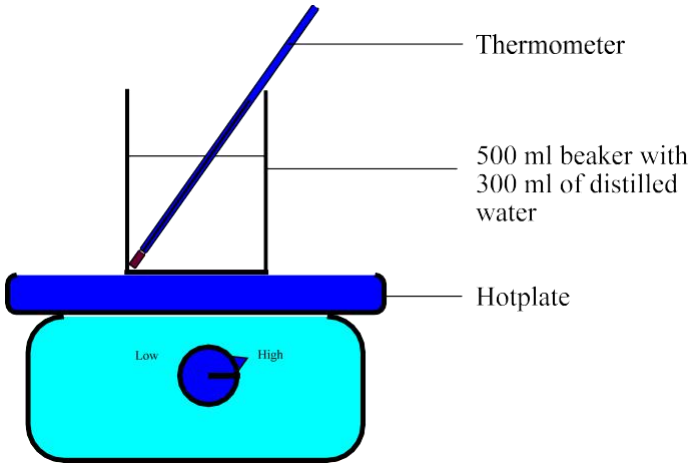

Figure 1. The equipment for this experiment was set up as shown in this figure.

Results

Quantitative Results

Table 1 Graph displaying data obtained from the heating of water from 0 to 16 minutes.

Time (minutes)	0	2	4	6	8	10	12	14	16
Temp (^{o}C)	20.05	41.46	60.62	79.39	97.11	99.68	99.51	99.51	99.51

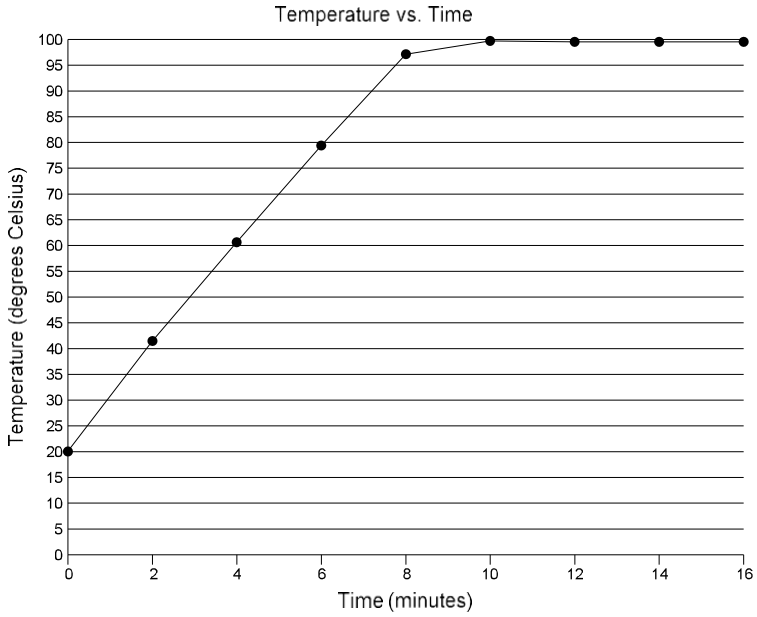

Figure 2. A line graph of temperature versus time of the data obtained in Table 1.

Calculation of percent error:

$$\% \text{ error} = \left| \frac{\text{theoretical value - experimental value}}{\text{theoretical value}} \right| \times 100$$

$$= \left| \frac{100.00\ ^{o}\text{C} - 99.51\ ^{o}\text{C}}{100.00\ ^{o}\text{C}} \right| \times 100$$

$$= \frac{0.49\ ^{o}\text{C}}{100.00\ ^{o}\text{C}} \times 100$$

$$= 0.49\ \% \text{ error}$$

Qualitative Results

Numerous small bubbles formed at the bottom of the beaker at 70.6 ^{o}C. The size and rate of bubble formation increased as the temperature increased. At 100.0 ^{o}C the rate and size of bubble formation remained constant. At that temperature, there was constant production of steam.

Conclusion

It was determined from the data plotted in the temperature versus time graph (Figure 2) that the boiling point of water is 99.51 ^{o}C. This concurs very closely with the stated hypothesis, therefore the experiment was deemed a success. The percent error was found to be 0.49%. Possible sources of error could have involved impurities in the water and human error in reading the thermometer. Possible sources of the impurities in the water are chemicals from dirty glassware. Improvements would include more accurate thermometers, clean equipment and proper reading of the thermometer.

Literature Cited

Kane, Joseph W. and Morton M. Sternheim. Physics.
New York: John Wiley & Sons, 1984 ed.

Merck, Josef. Merck Index of Chemical Constants. New
York: Benjamin/Cummings Publishing Company Inc. 1976.