Heat and Temperature

INTRODUCTION

Heat differs from temperature in that **heat** is a quantity of energy whereas **temperature** is a measure of the hotness or coldness of an object. Indeed, temperature is a physical property that determines the direction of heat flow. Heat always transfers from hot objects to cold ones. For example, if you touch an ice cube, heat flows out of your hand to the ice, cooling your hand. The **specific heat capacity** is the amount of heat required to raise the temperature of 1g or 1mol of substance by 1°C.

In this experiment you will investigate

a) the calibration of a thermometer as a temperature-measuring device
b) the determination of the specific heat capacity of a given metal

Table 2-1 Boiling point of water at various pressures

Pressure		
mm-Hg	atm	Bp, °C
700	0.921	97.7
705	0.928	97.9
710	0.934	98.1
715	0.941	98.3
720	0.947	98.5
725	0.954	98.7
730	0.961	98.9
735	0.967	99.1
740	0.974	99.3
745	0.980	99.4
750	0.987	99.6
755	0.993	99.8
760	1.000	100.0
765	1.007	100.2
770	1.013	100.4

The thermometer can be calibrated by immersing it first in melting ice (0°C) and than in boiling water (100°C at 1 atm pressure). Since the boiling point of water varies with changing barometric pressure. Table 2-1 will enable you to find the t rue boiling point of water under the conditions of the experiment. To determine the specific heat capacity of a metal, you will heat a weighed amount of metal to a known temperature (that of boiling water), and then place the hot metal in a known amount of water. From the temperature rise of the water, you can calculate the amount of heat transferred from the metal to the water. This can be done directly because it takes 4.2 joules (or 1 calorie) to raise 1 g of water by 1°C. Since the density of water is almost exactly 1 g per mL. 1 g of water is very nearly 1 mL. The specific heat capacity of the metal is equal to the amount of heat liberated by the the metal divided by its temperature drop times its mass.

PROCEDURE

a) Wash off some crushed ice, and place it in a small beaker. Add distilled water until the ice is nearly covered. Immerse your thermometer in the ice-water mixture as deep as possible; stir gently; record the thermometer reading when it has become constant.

Place about 100 mL of distilled water in your 500 mL flask. Drop in a boiling chip to prevent bumping during boiling. Insert your thermometer into the water. Heat the water to boiling and record the thermometer reading when it has become constant. Record the barometric pressure.

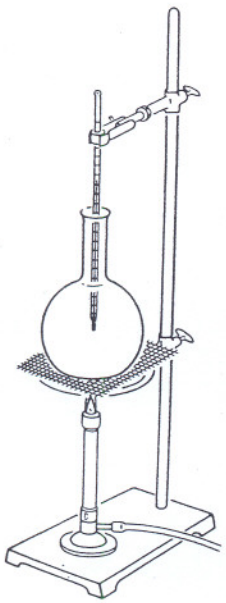

Figure 2-1

b) Obtain a piece of metal (about 10 g) for which the specific heat is to be found. Weigh it to the nearest 0.1 g. Tie it with a string and suspend it above boiling water in a flask as the thermometer is set in Figure 2-1. Do not let the metal get wet. (If water condenses on the metal, pull the metal out, dry, and replace.) Allow sufficient time for the metal to reach the temperature of the vapor from boiling water. Record the barometric pressure. With a graduated cylinder, measure 10.0 mL of distilled water into a test tube. Prop the test tube in the mouth of your 300 mL flask. Measure the temperature of the water to the nearest 0.1°. Withdraw the thermometer, and hold it directly over the test tube so that any drops of water will drain back. Quickly remove the heated metal, and carefully lower it into the water in the test tube. Stir by raising and lowering the metal. Return the thermometer, and note the maximum temperature registered.

PRELAB QUESTIONS

1- Define
Boiling point, Normal Boiling Point, Normal Freezing point

2- What is the difference between heat capacity and specific heat capacity ?

Heat and Temperature

Date:

A)

Thermometer reading in ice-water mixture .....

Thermometer reading at water boiling point .....

Barometric pressure .....

B)

Weight of metal .....

Temperature of the heated metal .....

Temperature of the water in the test tube .....

Temperature of the water and metal mixture .....

Name of the student: **Submitted to :**