Name: _____

Partner #1: _____

Partner #2: _____

LAB: TEMPERATURE OF A BUNSEN BURNER

INTRODUCTION

When a hot solid is immersed in a cool liquid, heat flows from the hot object to thee cool liquid. In fact, the number of joules of energy lost by the hot solid (ΔQ_1) exactly equals the number of joules of energy gained by the cool liquid (ΔQ_2).

$$-(\Delta Q_1) = (\Delta Q_2)$$

The quantity of heat that flows is function of the object's mass and its specific heat. Each different material has a characteristic specific heat. If thee mass, temperature change, and specific heat of the substance are known, the heat lost or gain can be easily calculated. In this experiment you will determine the temperature of a Bunsen burner flame by heating a known sample of metal in the flame and then immersing the hot metal at temperature t_1 into a measured quantity of water at temperature t_2. As the heat flows from the hot metal to the cool water, the two materials approach an intermediate temperature t_3. See Figure 1.

By solving for T_1 the initial temperature of the hot metal can be found. The metal should be the same temperature as the Bunsen Burner flame

$$-(\Delta Q_1) = (\Delta Q_2)$$
$$-(m_1)(sp.ht_1)(T_3-T_1) = (m_2)(sp\ ht_2)(T_3-T_2)$$

As the metal object is heated in a properly adjusted Bunsen burner flame, the object will start to glow. All materials begin to emit dim red light when a temperature of approximately 750^0C is reached. As the material becomes hotter, the light becomes whiter in color. This explains why the nichrome wire of the toaster glows red and the tungsten filament of a incandescent light bulb glows white; while operating, the toaster's heating element is at a lower temperature than the light bulb's tungsten filament. To emit light, the nichrome and tungsten must be above a temperature of 750^0C. Even the small filament of lit flashlight bulb is at a temperature much higher than 750^0C.

MATERIALS

Centegram balance	ring stand
Ring	nichrome wire, 20 cm length
Bunsen Burner	Styrofoam cup
Thermometer	Metal object, 20-30 grams (Cu, Fe, Mn, Ni, Pt, or W)

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PROCEDURE

1. Mass an empty Styrofoam cup to the nearest 0.01 g and record in the data table. Fill the cup about two-thirds full of water. Reweigh and record. Read and record the temperature of the water.
2. Mass the metal object to the nearest 0.01 g and record. Use the nichrome wire to attach the metal object 7 or 8 cm below he ring of a ring stand.
3. Adjust the Bunsen burner so that it produces a hot, blue flame. Move the flame under the metal object and heat for about 5 minutes. Afterwards turn off the Bunsen burner and SLOWLY lift the cup so that the hot metal becomes immersed in the water. After a minute, read and record the temperature of the water

Table 1
Specific Heats of Materials

Substance	Specific Heat J/gC^0
Copper	0.385
Iron	0.444
Manganese	0.481
Nickel	0.470
Platinum	0.131
Tungsten	0.134
Water	4.18

Due Date: _____

DATA

Data Table	
Type of Metal Used	
Mass of metal object	g
Specific Heat of Metal Object (from Table 1)	J/gC^0
Mass of empty styrofoam cup	g
Mass of styrofoam cup and water	g
Temperature of water (before metal is inserted)	^0C
Temperature of water (after metal was inserted)	^0C

CALCULATIONS

1. Calculate the change in temperature of the water
2. Determine the initial mass of the water heated
3. Calculate the heat gained by the water
4. Calculate the temperature of the hot metal object.

ANALYSIS

1. From the specific heats of the metals listed in Table 1, which metal would raise the temperature of water the greatest in the experiment? Which the least?
2. Error is present in every experiment. In this experiment you neglected he small mass of water that was changed to steam when the hot sample was initially immersed in the water. Would this tend to make the calculated temperature lower r higher than the actual temperature f the flame? Explain.
3. It takes about 2.26 kilojoules of energy to evaporate each gram of water. Suggest a way to include the evaporated water in your calculation.
4. Another error that was neglected comes from the small amount of hot nichrome wire that was also immersed in the water. Would this tend to make the calculated temperature lower or higher than the actual temperature of the flame? Explain.
5. If 100 grams of boiling water at 100^0C is poured into a 100 gram platinum beaker at 0^0C, and intermediate temperature will result. Knowing that the specific heat of water is about 32 times larger than the specific heat of platinum, calculate the resulting temperature. Show your work