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The Calorie

Introduction

When two different objects with different temperatures come into contact, energy is transferred from the warmer to the colder object until an equilibrium temperature is achieved. This is a concept that you already use every day. For example, if your coffee is too hot, you may add a little cold milk. The coffee transfers energy to the milk until they are both the same temperature.

The standard unit for measuring the thermal energy transferred between two objects is the calorie. This is not to be confused with the calories in a big fat honey bun. Food labels actually show you kilo-calories. The calorie is defined as the amount of energy necessary to raise the temperature of one gram of water one degree Celsius.

In this experiment you will verify the principle of conservation of energy by combining two samples, of known mass, of hot and cold water. The amount of energy lost by the hot water should equal the amount of energy gained by the cold water.

$$\Delta E_{hot} = (M_{hot})*(T_{hot}-T_{eq})*(1cal/gC^{o})$$

$$\Delta E_{cold} = (M_{cold})*(T_{eq}-T_{cold})*(1cal/gC^{o})$$

These two equations should yield the same value if energy is conserved.

Materials

Foam calorimeter, balance, hot and cold water.

Procedure

Record the mass of the empty calorimeter. Fill the calorimeter about 1/3 full with cold water and determine the mass of water in the calorimeter. Fill a second calorimeter 1/3 full with hot water and determine the mass of the hot water. Measure the exact temperatures of both samples.

Immediately mix the two samples and stir with the thermometer until the temperature stops changing. Record the equilibrium temperature and the mass of the combined water samples.

Perform all of the necessary calculations to determine the energy lost from the hot water sample and the energy gained by the cold water.

Repeat this experiment twice with different masses of hot and cold water.

Conclusion

Show all of your calculations in the final report.

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In your conclusion briefly discuss the principle that was taught in this lab and describe any unwanted sources of heat loss or gain that may have had an effect on the experiment. Which of the two water samples had more thermal energy before mixing?