LAB 22, MECHANICAL EQUIVALENT OF HEAT

Name _____ Period_____

We shall drop a specific mass of lead shot inside a PVC pipe and measure the resultant increase in temperature. When the lead shot falls the length of the pipe and hits the other end, virtually all the kinetic energy of the shot will be converted into heat energy. Because of the insulating properties of the cork and the PVC walls of the pipe, this heat energy will be confined mostly to the shot and consequently raise its temperature.

OBJECTIVE:

After completing this experiment, you should be able to make an approximate determination of the mechanical equivalent of heat.

PROCEDURE (SHOW ALL CALCULATIONS, 1,2,3,4):

1. Measure the mass of the calorimeter cup and record it in the data table:

2. **Carefully** pour the shot into the cup and measure the mass of the cup and shot. Record it.

3. Calculate the mass of the shot by subtracting the mass of the cup from the total mass. Enter the result into the data table.

4. Carefully measure the temperature of the shot. (**Be careful not to break the thermometer**.) Record in the data table.

5. Pour the shot into the pipe. Close the open end of the tube with the stopper. Then invert the pipe 100 times. **WARNING! Firmly hold the cork at all times to prevent the shot from shooooting all over the place!** You must invert the pipe such as to make the shot fall through the entire length of the tube.

6. After the last inversion of the tube, quickly pour the shot back into the cup and take the temperature. Record in the data table.

The tube is 1 meter long, so the total distance dropped is 100 meters.

CALCULATIONS:

1. By using the equation, **PE = mgh, where PE is the potential energy in joules, m is the mass in KILOGRAMS, g = 9.8m/s^2, and h is the height in meters** (100m), calculate the potential energy of the shot. **NOTE: Kilograms = grams/1000g/kg.** Record in the Calculations Table.

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2. Determine the temperature change of the shot, **Δt**, by taking the difference between the first and second temperatures. Record in Calculations Table.

3. From a Specific Heat Table we find that the specific heat, **c**, of lead shot is **0.03 cal/gC^{o}**. Calculate the heat gained by the shot. **HINT: Q = mcΔt, Q is in calories, m is in GRAMS, and Δt is in C^{o}.** Record in Calculations Table.

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4. Determine the mechanical equivalent of heat in the experiment by dividing the joules of PE by the calories of heat. It's in joules/calorie. Record in Calculations Table.

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5. Find the percentage error. **HINT: Percent error = your error/accepted value X 100%. The accepted value is (4.18j/cal).** Record in Calculations Table.

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Data & Calculations Table

Mass of empty cup _____ g	Distance Dropped _____ 100 m
Mass of cup + shot _____ g	PE at 100 meters _____ J
Mass of shot _____ g	Sp Ht of shot = ... 0.03 cal/gC^{o}
Initial temp of shot _____ ^{o}C	Heat gained by shot _____ cal
Final temp of shot _____ ^{o}C	Mech equivalent _____ j/cal
Temp change of shot _____ C^{o}	Your error _____ j/cal
.	Percent error _____ %

QUESTIONS:

1. Could this experiment be completed without measuring the mass of the shot? Explain.

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2. What are the main sources of error in this experiment?

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CRITIQUE: