Measuring the temperature of a Cu bar

Lab-report in Physics
Preformed 98-03-25

The aim with this experiment is to learn how to use measure the temperature of a sold material, by transferring the temperature from the solid material to water and then calculate the initial temperature.

In preparation we have filled a thermos bottle with a known amount of water (m_{H2O}, by weighing the bottle before and after filling it with water). We have also measured the temperature of the water (T_{H2O}). Now we weighed (m_{Cu})and heated the copper bar to a very high temperature, and then put the bar into the thermos bottle. After some time, half a minute or so, the water and copper bar has reached the same temperature, thermal equilibrium, and we now measure the temperature of the water (T). And that is all we need to know. We just put the values into the formula and start to calculate:

$$m_{Cu} \cdot c_{Cu} \cdot \Delta T_{Cu} = m_{H_2O} \cdot c_{H_2O} \cdot \Delta T_{H_2O}$$

$$m_{Cu} \cdot c_{Cu} \cdot T_{Cu} - m_{Cu} \cdot c_{Cu} \cdot T = m_{H_2O} \cdot c_{H_2O} \cdot T - m_{H_2O} \cdot c_{H_2O} \cdot T_{H_2O}$$

$$T_{Cu} = \frac{m_{Cu} \cdot c_{Cu} \cdot T + m_{H_2O} \cdot c_{H_2O} \cdot T - m_{H_2O} \cdot c_{H_2O} \cdot T_{H_2O}}{m_{Cu} \cdot c_{Cu}}$$

So, in the experiment we did, these are the values we got:

$$m_{H_2O} = 382,2\,g$$
$$m_{Cu} = 225,7\,g$$
$$T_{H_2O} = 13°C$$
$$T = 17°C$$
$$c_{H_2O} = 4187\,J/kg \cdot °C$$
$$c_{Cu} = 390\,J/kg \cdot °C$$

And the result is:

$$T_{Cu} = \frac{0,2257 \cdot 390 \cdot 17 + 0,3822 \cdot 4187 \cdot 17 - 0,3822 \cdot 4187 \cdot 13}{0,2257 \cdot 390}$$

$$T_{Cu} = 89,72°C$$

So this is a quite simple way to measure the temperature of a solid item.