15.2.1: Lecture Demonstrations

Mercury (10 cc) and 10 cc of water in test tubes at room temperature (with thermistors interfaced to computer, if possible). Allow both tubes to equilibrate to room temperature (~17 ^{o}C), then immerse them simultaneously in a water bath at 34 ^{o}C. Will 136 g of mercury heat up faster or slower than 10 g of water? Measure T every 1 second with interfaced computer. Plot. Paradoxically, mercury increases in T much faster. The amount of heat absorbed by each is roughly equivalent, since the test tubes and volumes are identical. Small differences result from the change in rate of heat transfer across the glass with ΔT.

Figure 15.2.1.1Mercury and water in test tubes

Choose T_f at any time, and calculate ΔT for Hg and water. Assume q absorbed is same for both, and calculate Cp for Hg from q = m x C x ΔT for water.

The q/T Paradox: Which "Contains More Heat", a Cup of Coffee at 95 °C or a Liter of Icewater?[1]

A small mass of water at 0^{o}C is added to a measured mass of liquid nitrogen, and the amount that evaporates is compared to the mass that evaporates when a larger mass of water at 95^{o}C is added to liquid nitrogen. This demonstration requires knowledge of both specific heat and heat capacity.

References

1. J. Chem. Educ., 2005, 82 (6), p 856