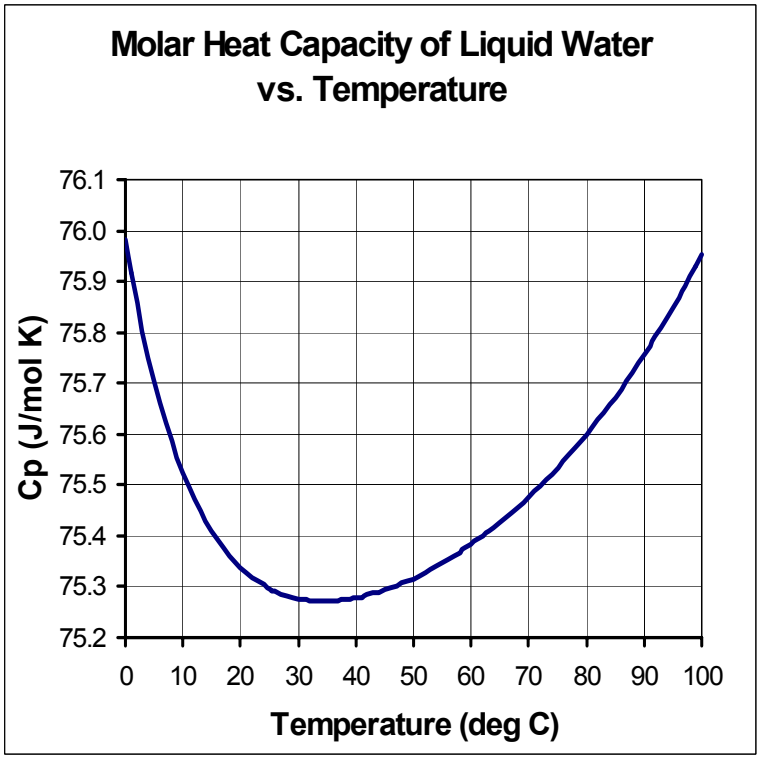
## Heat Capacity and Temperature Change

From thermochemistry we have seen that the temperature change caused by gain or loss of a certain amount of heat, $q$, depends upon the heat capacity of the substance, $C_p$, according to the equation

$$q = C_p \Delta T$$

However, this equation is valid only for small changes in temperature, over which $C_p$ is nearly constant. Actually, the heat capacity itself changes with temperature. For example, the graph below shows the variation of molar heat capacity (J/mol·K) for water throughout its liquid range.




As this suggests, it would not be accurate to calculate, say, the amount of heat required to warm a given sample of water from 0 °C to 100 °C using a single value of $C_p$. In careful work, it is necessary to take the sum of the heats required to effect a series of very small temperature changes that add up to the range of interest, using a different nearly constant value of $C_p$ for each small increment. For our purposes, where a high degree of accuracy is not required, we can use an average value of $C_p$ for the temperature range of interest, so long as we confine our calculations to cases involving relatively limited temperature changes.