Answer on Question #43897, Physics, Molecular Physics — Thermodynamics

can the specific heat at constant volume be greater than the specific heat at constant pressure. Justify by applying the first law of thermodynamics.

Solution

First law is

$$dU = dA + \delta Q = pdV + \delta Q$$

So, when a gas is heated at constant volume,no external work is done and so the heat supplied is consumed only in increasing the internal energy of a gas.

But if the gas is heated at constant pressure , the gas expands against the external pressure so does some external work.In this case the supplied heat is used up in increasing the internal energy of the gas and in doing some external work .

Since the internal energy is depends only on temperature,for the same rise of temperature the internal energy of a mass of a gas will increase by the same amount whether the pressure or volume remains constant.But since external work is additionally done for constant pressure than at constant volume to produce the same rise in temperature of the gas.

Above is the reason for C_p is always greater than C_v.