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# GENERALISED MAYER'S RELATION

**Statement**

Deduce the generalised Mayer relation, $c_p$-$c_V$=$vT\alpha^2/\kappa$, from the deffinition of the coefficients.

Demostrar la relación de Mayer generalizada, $c_p$-$c_V$=$vT\alpha^2/\kappa$, a partir de las definiciones de los coeficientes.

**Solution**. In general $ds=\left.\frac{\partial s}{\partial T}\right|_p dT+\left.\frac{\partial s}{\partial p}\right|_T dp$, and from definition of $c_p$ (4.9) and Maxwell relation (4.8) $ds=\frac{c_p}{T}dT-\alpha v dp$. Dividing the first equation by dT and choosing the direction of v=constant $\frac{ds}{dT}=\left.\frac{\partial s}{\partial T}\right|_p+\left.\frac{\partial s}{\partial p}\right|_T\frac{dp}{dT}$, $\left.\frac{\partial s}{\partial T}\right|_v=\left.\frac{\partial s}{\partial T}\right|_p+\left.\frac{\partial s}{\partial p}\right|_T\left.\frac{\partial p}{\partial T}\right|_v=\frac{c_v}{T}=\frac{c_p}{T}-\frac{\alpha^2 v}{\kappa}$, where the definition of $c_v$ (4.12) has being substituted, demonstrating the generalised Mayer relation.

**Comments**. Mayer proposed the relation $c_p$-$c_V$=$R$, that is valid only for the special case of an ideal gas, where $\alpha$=1/$T$, $\kappa$=1/$p$ and $v$=$RT/p$.

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