

Property	Formulation
$\left(\frac{\partial^2 p}{\partial \varrho^2}\right)_T$	$= \frac{TR}{\varrho} [2\delta\alpha_\delta^r + 4\delta^2\alpha_{\delta\delta}^r + \delta^3\alpha_{\delta\delta\delta}^r]$
$\left(\frac{\partial^2 p}{\partial T^2}\right)_\varrho$	$= \frac{\varrho R}{T} [\tau^2\delta\alpha_{\tau\tau\delta}^r]$
$\left(\frac{\partial^2 p}{\partial \varrho \partial T}\right)$	$= R [1 + 2\delta\alpha_\delta^r + \delta^2\alpha_{\delta\delta}^r - 2\delta\tau\alpha_{\tau\delta}^r - \tau\delta^2\alpha_{\tau\delta\delta}^r]$
$\left(\frac{\partial^2 s}{\partial \varrho^2}\right)_T$	$= \frac{R}{\varrho^2} [1 - \delta^2\alpha_{\delta\delta}^r + \tau\delta^2\alpha_{\tau\delta\delta}^r]$
$\left(\frac{\partial^2 s}{\partial T^2}\right)_\varrho$	$= \frac{R}{T^2} [\tau^3(\alpha_{\tau\tau\tau}^0 + \alpha_{\tau\tau\tau}^r) + 3\tau^2(\alpha_{\tau\tau}^0 + \alpha_{\tau\tau}^r)]$
$\left(\frac{\partial^2 s}{\partial \varrho \partial T}\right)$	$= \frac{R}{T\varrho} [-\tau^2\delta\alpha_{\tau\tau\delta}^r]$
$\left(\frac{\partial^2 u}{\partial \varrho^2}\right)_T$	$= \frac{TR}{\varrho^2} [\tau\delta^2\alpha_{\tau\delta\delta}^r]$
$\left(\frac{\partial^2 u}{\partial T^2}\right)_\varrho$	$= \frac{R}{T} [\tau^3(\alpha_{\tau\tau\tau}^0 + \alpha_{\tau\tau\tau}^r) + 2\tau^2(\alpha_{\tau\tau}^0 + \alpha_{\tau\tau}^r)]$
$\left(\frac{\partial^2 u}{\partial \varrho \partial T}\right)$	$= \frac{R}{\varrho} [-\tau^2\delta\alpha_{\tau\tau\delta}^r]$
$\left(\frac{\partial^2 h}{\partial \varrho^2}\right)_T$	$= \frac{TR}{\varrho^2} [\tau\delta^2\alpha_{\tau\delta\delta}^r + 2\delta^2\alpha_{\delta\delta}^r + \delta^3\alpha_{\delta\delta\delta}^r]$
$\left(\frac{\partial^2 h}{\partial T^2}\right)_\varrho$	$= \frac{R}{T} [\tau^3(\alpha_{\tau\tau\tau}^0 + \alpha_{\tau\tau\tau}^r) + 2\tau^2(\alpha_{\tau\tau}^0 + \alpha_{\tau\tau}^r) + \tau^2\delta\alpha_{\tau\tau\delta}^r]$
$\left(\frac{\partial^2 h}{\partial \varrho \partial T}\right)$	$= \frac{R}{\varrho} [\delta^2\alpha_{\delta\delta}^r - \tau^2\delta\alpha_{\tau\tau\delta}^r + \delta\alpha_\delta^r - \tau\delta^2\alpha_{\tau\delta\delta}^r - \tau\delta\alpha_{\tau\delta}^r]$
$\left(\frac{\partial^2 g}{\partial \varrho^2}\right)_T$	$= \frac{TR}{\varrho^2} [-1 + 3\delta^2\alpha_{\delta\delta}^r + \delta^3\alpha_{\delta\delta\delta}^r]$
$\left(\frac{\partial^2 g}{\partial T^2}\right)_\varrho$	$= \frac{R}{T} [\tau^2(\alpha_{\tau\tau}^0 + \alpha_{\tau\tau}^r) + \tau^2\delta\alpha_{\tau\tau\delta}^r]$
$\left(\frac{\partial^2 g}{\partial \varrho \partial T}\right)$	$= \frac{R}{\varrho} [1 + 2\delta\alpha_\delta^r - 2\tau\delta\alpha_{\tau\delta}^r + \delta^2\alpha_{\delta\delta}^r - \tau\delta^2\alpha_{\tau\delta\delta}^r]$

Definition	Transformation
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$$\left(\frac{\partial^2 T}{\partial p^2}\right)_q = -\left(\frac{\partial^2 p}{\partial T^2}\right)_q \left(\frac{\partial p}{\partial T}\right)_q^{-3}$$

$$\begin{aligned} \left(\frac{\partial^2 T}{\partial q^2}\right)_p &= -\left[\left(\frac{\partial^2 p}{\partial q^2}\right)_T \left(\frac{\partial p}{\partial T}\right)_q - \left(\frac{\partial p}{\partial q}\right)_T \left(\frac{\partial^2 p}{\partial T \partial q}\right)\right] \left(\frac{\partial p}{\partial T}\right)_q^{-2} \\ &\quad + \left[\left(\frac{\partial^2 p}{\partial T \partial q}\right) \left(\frac{\partial p}{\partial T}\right)_q - \left(\frac{\partial p}{\partial q}\right)_T \left(\frac{\partial^2 p}{\partial T^2}\right)_q\right] \left(\frac{\partial p}{\partial T}\right)_q^{-3} \left(\frac{\partial p}{\partial q}\right)_T \end{aligned}$$

$$\left(\frac{\partial^2 T}{\partial p \partial q}\right) = -\left[\left(\frac{\partial^2 p}{\partial T \partial q}\right) \left(\frac{\partial p}{\partial T}\right)_q - \left(\frac{\partial p}{\partial q}\right)_T \left(\frac{\partial^2 p}{\partial T^2}\right)_q\right] \left(\frac{\partial p}{\partial T}\right)_q^{-3}$$

$$\left(\frac{\partial^2 q}{\partial p^2}\right)_T = -\left(\frac{\partial^2 p}{\partial q^2}\right)_T \left(\frac{\partial p}{\partial q}\right)_T^{-3}$$

$$\begin{aligned} \left(\frac{\partial^2 q}{\partial T^2}\right)_p &= -\left[\left(\frac{\partial^2 p}{\partial T^2}\right)_q \left(\frac{\partial p}{\partial q}\right)_T - \left(\frac{\partial p}{\partial T}\right)_q \left(\frac{\partial^2 p}{\partial T \partial q}\right)\right] \left(\frac{\partial p}{\partial q}\right)_T^{-2} \\ &\quad + \left[\left(\frac{\partial^2 p}{\partial T \partial q}\right) \left(\frac{\partial p}{\partial q}\right)_T - \left(\frac{\partial p}{\partial T}\right)_q \left(\frac{\partial^2 p}{\partial q^2}\right)_T\right] \left(\frac{\partial p}{\partial q}\right)_T^{-3} \left(\frac{\partial p}{\partial T}\right)_q \end{aligned}$$

$$\left(\frac{\partial^2 q}{\partial T \partial p}\right) = -\left[\left(\frac{\partial^2 p}{\partial T \partial q}\right) \left(\frac{\partial p}{\partial q}\right)_T - \left(\frac{\partial p}{\partial T}\right)_q \left(\frac{\partial^2 p}{\partial q^2}\right)_T\right] \left(\frac{\partial p}{\partial q}\right)_T^{-3}$$

$$\begin{aligned} \left(\frac{\partial c_p}{\partial T}\right)_q &= \left(\frac{\partial^2 h}{\partial T^2}\right)_q + \left(\frac{\partial h}{\partial q}\right)_T \left(\frac{\partial p}{\partial T}\right)_q \left(\frac{\partial^2 p}{\partial T \partial q}\right) \left(\frac{\partial p}{\partial q}\right)_T^{-2} \\ &\quad - \left[\left(\frac{\partial^2 h}{\partial T \partial q}\right) \left(\frac{\partial p}{\partial T}\right)_q + \left(\frac{\partial h}{\partial q}\right)_T \left(\frac{\partial^2 p}{\partial T^2}\right)_q\right] \left(\frac{\partial p}{\partial q}\right)_T^{-1} \end{aligned}$$

$$\begin{aligned} \left(\frac{\partial c_p}{\partial q}\right)_T &= \left(\frac{\partial^2 h}{\partial T \partial q}\right) + \left(\frac{\partial h}{\partial q}\right)_T \left(\frac{\partial p}{\partial T}\right)_q \left(\frac{\partial^2 p}{\partial q^2}\right)_T \left(\frac{\partial p}{\partial q}\right)_T^{-2} \\ &\quad - \left[\left(\frac{\partial^2 h}{\partial q^2}\right)_T \left(\frac{\partial p}{\partial T}\right)_q + \left(\frac{\partial h}{\partial q}\right)_T \left(\frac{\partial^2 p}{\partial T \partial q}\right)\right] \left(\frac{\partial p}{\partial q}\right)_T^{-1} \end{aligned}$$

$$\left(\frac{\partial c_p}{\partial p}\right)_h = \frac{\left(\frac{\partial c_p}{\partial T}\right)_q \left(\frac{\partial h}{\partial q}\right)_T - \left(\frac{\partial c_p}{\partial q}\right)_T \left(\frac{\partial h}{\partial T}\right)_q}{\left(\frac{\partial p}{\partial T}\right)_q \left(\frac{\partial h}{\partial q}\right)_T - \left(\frac{\partial p}{\partial q}\right)_T \left(\frac{\partial h}{\partial T}\right)_q}$$