

Isobar in a vT -diagram

The slope of the isobar in a vT -diagram (T on the horizontal axis) given by the partial derivative $\left(\frac{\partial v}{\partial T}\right)_P$ for an ideal gas is:

The equation of state for an ideal gas is:

$$Pv = RT \rightarrow v = \frac{RT}{P} \quad (1)$$

$$\left(\frac{\partial v}{\partial T}\right)_P = \frac{R}{P} = \frac{v}{T} \quad (2)$$

P and R are always positive, so $\frac{R}{P}$ is always positive (in diagram it has a rising slope, the smaller P the steeper the slope) and also $\frac{v}{T}$ is always positive as v and T are also always positive (in a diagram the positive slope gets steeper if T gets smaller).