

Entropy Change of Pure Substances

-Can be obtained from Tds Relations in conjunction with other thermodynamic relations

-For 2 phase substances like *water* and *R-134a*, use property tables

$$\Delta S = S_2 - S_1$$

For **ideal gas**, from *Tds relations*

$$ds = \frac{du}{T} + \frac{pdv}{T}$$

$$ds = C_v \frac{dT}{T} + R \frac{dv}{v}$$

$$\int ds = \int C_v \frac{dT}{T} + \int R \frac{dv}{v}$$

$$\Delta S = s_2 - s_1 = C_v \ln \frac{T_2}{T_1} + R \ln \frac{v_2}{v_1}$$

$$du = C_v dT$$

$$pv = RT \rightarrow \frac{p}{T} = \frac{R}{v}$$

Assume $C_v = \text{constant}$
& integrate

Another relation,

$$dh = C_p dT$$

$$pv = RT \rightarrow \frac{p}{T} = \frac{R}{v}$$

Assume $C_p = \text{constant}$
& integrate

$$ds = \frac{dh}{T} - \frac{vdp}{T}$$

$$ds = C_p \frac{dT}{T} - R \frac{dp}{p}$$

$$\int ds = \int C_p \frac{dT}{T} - \int R \frac{dp}{p}$$

$$\Delta S = s_2 - s_1 = C_p \ln \frac{T_2}{T_1} - R \ln \frac{p_2}{p_1}$$

$$\Delta s = s_2 - s_1 = C_v \ln \frac{T_2}{T_1} + R \ln \frac{v_2}{v_1}$$

$$\Delta s = s_2 - s_1 = C_p \ln \frac{T_2}{T_1} - R \ln \frac{p_2}{p_1}$$

Both equations give the same result
Choose according to available data..