TABLE 9.1

Ideal Gas Model Review

Equations of state:

$$pv = RT \tag{3.32}$$

$$pV = mRT \tag{3.33}$$

Changes in u and h:

$$u(T_2) - u(T_1) = \int_{T_1}^{T_2} c_v(T)\,dT \tag{3.40}$$

$$h(T_2) - h(T_1) = \int_{T_1}^{T_2} c_p(T)\,dT \tag{3.43}$$

Constant Specific Heats	Variable Specific Heats
$u(T_2) - u(T_1) = c_v(T_2 - T_1)$ (3.50) $h(T_2) - h(T_1) = c_p(T_2 - T_1)$ (3.51) See Tables A-20, 21 for data.	$u(T)$ and $h(T)$ are evaluated from appropriate tables: Tables A-22 for air (mass basis) and A-23 for other gases (molar basis).

Changes in s:

$$s(T_2, v_2) - s(T_1, v_1) = \int_{T_1}^{T_2} c_v(T)\frac{dT}{T} + R\ln\frac{v_2}{v_1} \tag{6.17}$$

$$s(T_2, p_2) - s(T_1, p_1) = \int_{T_1}^{T_2} c_p(T)\frac{dT}{T} - R\ln\frac{p_2}{p_1} \tag{6.18}$$

Constant Specific Heats	Variable Specific Heats
$s(T_2, v_2) - s(T_1, v_1) = c_v\ln\frac{T_2}{T_1} + R\ln\frac{v_2}{v_1}$ (6.21) $s(T_2, p_2) - s(T_1, p_1) = c_p\ln\frac{T_2}{T_1} - R\ln\frac{p_2}{p_1}$ (6.22) See Tables A-20, 21 for data.	$s(T_2, p_2) - s(T_1, p_1) = s^\circ(T_2) - s^\circ(T_1) - R\ln\frac{p_2}{p_1}$ (6.20a) where $s^\circ(T)$ is evaluated from appropriate tables: Tables A-22 for air (mass basis) and A-23 for other gases (molar basis).

Relating states of equal specific entropy: $\Delta s = 0$:

Constant Specific Heats	Variable Specific Heats — Air Only
$\frac{T_2}{T_1} = \left(\frac{p_2}{p_1}\right)^{(k-1)/k}$ (6.43) $\frac{T_2}{T_1} = \left(\frac{v_1}{v_2}\right)^{k-1}$ (6.44) $\frac{p_2}{p_1} = \left(\frac{v_1}{v_2}\right)^{k}$ (6.45) where $k = c_p/c_v$ is given in Tables A-20 for several gases.	$\frac{p_2}{p_1} = \frac{p_{r2}}{p_{r1}}$ (air only) (6.41) $\frac{v_2}{v_1} = \frac{v_{r2}}{v_{r1}}$ (air only) (6.42) where p_r and v_r are provided for air in Tables A-22.