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Bridgman Tables
Convenient for Single-component Volume Explicit Equations of State

I. Pressure

1. $(\partial V)_p = -(\partial p)_V = \left(\frac{\partial V}{\partial T}\right)_p$

2. $(\partial T)_p = -(\partial p)_T = 1$

3. $(\partial S)_p = -(\partial p)_S = \frac{C_p}{T}$

4. $(\partial U)_p = -(\partial p)_U = C_p - p\left(\frac{\partial V}{\partial T}\right)_p$

5. $(\partial H)_p = -(\partial p)_H = C_p$

6. $(\partial A)_p = -(\partial p)_A = -\left[S + p\left(\frac{\partial V}{\partial T}\right)_p\right]$

7. $(\partial G)_p = -(\partial p)_G = -S$

II. Temperature

1. $(\partial V)_T = -(\partial T)_V = -\left(\frac{\partial V}{\partial p}\right)_T$

2. $(\partial p)_T = -(\partial T)_p = -1$

3. $(\partial S)_T = -(\partial T)_S = \left(\frac{\partial V}{\partial T}\right)_p$

4. $(\partial U)_T = -(\partial T)_U = T\left(\frac{\partial V}{\partial T}\right)_p + p\left(\frac{\partial V}{\partial p}\right)_T$

5. $(\partial H)_T = -(\partial T)_H = -V + T\left(\frac{\partial V}{\partial T}\right)_p$

6. $(\partial A)_T = -(\partial T)_A = p\left(\frac{\partial V}{\partial p}\right)_T$

7. $(\partial G)_T = -(\partial T)_G = -V$

III. Volume

1. $$(\partial p)_V = -(\partial V)_p = -\left(\frac{\partial V}{\partial T}\right)_p$$

2. $$(\partial T)_V = -(\partial V)_T = \left(\frac{\partial V}{\partial p}\right)_T$$

3. $$(\partial S)_V = -(\partial V)_S = \frac{1}{T}\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right]$$

4. $$(\partial U)_V = -(\partial V)_U = C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2$$

5. $$(\partial H)_V = -(\partial V)_H = C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2 - V\left(\frac{\partial V}{\partial T}\right)_p$$

6. $$(\partial A)_V = -(\partial V)_A = -S\left(\frac{\partial V}{\partial p}\right)_T$$

7. $$(\partial G)_V = -(\partial V)_G = -\left[V\left(\frac{\partial V}{\partial T}\right)_p + S\left(\frac{\partial V}{\partial p}\right)_T\right]$$

IV. Entropy

1. $(\partial p)_S = -(\partial S)_p = -\frac{C_p}{T}$

2. $(\partial T)_S = -(\partial S)_T = -\left(\frac{\partial V}{\partial T}\right)_p$

3. $(\partial V)_S = -(\partial S)_V = -\frac{1}{T}\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right]$

4. $(\partial U)_S = -(\partial S)_U = \frac{p}{T}\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right]$

5. $(\partial H)_S = -(\partial S)_H = -V\frac{C_p}{T}$

6. $(\partial A)_S = -(\partial S)_A = \frac{p}{T}\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right] + S\left(\frac{\partial V}{\partial T}\right)_p$

7. $(\partial G)_S = -(\partial S)_G = -\frac{V}{T}C_p + S\left(\frac{\partial V}{\partial T}\right)_p$

V. Internal Energy

1. $$(\partial p)_U = -(\partial U)_p = -C_p + p\left(\frac{\partial V}{\partial T}\right)_p$$

2. $$(\partial T)_U = -(\partial U)_T = -\left[T\left(\frac{\partial V}{\partial T}\right)_p + p\left(\frac{\partial V}{\partial p}\right)_T\right]$$

3. $$(\partial V)_U = -(\partial U)_V = -\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right]$$

4. $$(\partial S)_U = -(\partial U)_S = -\frac{p}{T}\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right]$$

5. $$(\partial H)_U = -(\partial U)_H = -V\left[C_p - p\left(\frac{\partial V}{\partial T}\right)_p\right] - p\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right]$$

6. $$(\partial A)_U = -(\partial U)_A = p\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right] + S\left[T\left(\frac{\partial V}{\partial T}\right)_p + p\left(\frac{\partial V}{\partial p}\right)_T\right]$$

7. $$(\partial G)_U = -(\partial U)_G = -V\left[C_p - p\left(\frac{\partial V}{\partial T}\right)_p\right] + S\left[T\left(\frac{\partial V}{\partial T}\right)_p + p\left(\frac{\partial V}{\partial p}\right)_T\right]$$

VI. Enthalpy

1. $(\partial p)_H = -(\partial H)_p = -C_p$

2. $(\partial T)_H = -(\partial H)_T = V - T\left(\frac{\partial V}{\partial T}\right)_p$

3. $(\partial V)_H = -(\partial H)_V = -C_p\left(\frac{\partial V}{\partial p}\right)_T - T\left(\frac{\partial V}{\partial T}\right)_p^2 + V\left(\frac{\partial V}{\partial T}\right)_p$

4. $(\partial S)_H = -(\partial H)_S = V\frac{C_p}{T}$

5. $(\partial U)_H = -(\partial H)_U = V\left[C_p - p\left(\frac{\partial V}{\partial T}\right)_p\right] + p\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right]$

6. $(\partial A)_H = -(\partial H)_A = -\left[S + p\left(\frac{\partial V}{\partial T}\right)_p\right]\left[V - T\left(\frac{\partial V}{\partial T}\right)_p\right] + pC_p\left(\frac{\partial V}{\partial p}\right)_T$

7. $(\partial G)_H = -(\partial H)_G = -V\left[C_p + S\right] + TS\left(\frac{\partial V}{\partial T}\right)_p$

VII. Helmholtz Free Energy

1. $$(\partial p)_A = -(\partial A)_p = \left[S + p\left(\frac{\partial V}{\partial T}\right)_p\right]$$

2. $$(\partial T)_A = -(\partial A)_T = -p\left(\frac{\partial V}{\partial p}\right)_T$$

3. $$(\partial V)_A = -(\partial A)_V = S\left(\frac{\partial V}{\partial p}\right)_T$$

4. $$(\partial S)_A = -(\partial A)_S = -\frac{p}{T}\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right] - S\left(\frac{\partial V}{\partial T}\right)_p$$

5. $$(\partial U)_A = -(\partial A)_U = -p\left[C_p\left(\frac{\partial V}{\partial p}\right)_T + T\left(\frac{\partial V}{\partial T}\right)_p^2\right] - S\left[T\left(\frac{\partial V}{\partial T}\right)_p + p\left(\frac{\partial V}{\partial p}\right)_T\right]$$

6. $$(\partial H)_A = -(\partial A)_H = \left[S + p\left(\frac{\partial V}{\partial T}\right)_p\right]\left[V - T\left(\frac{\partial V}{\partial T}\right)_p\right] - pC_p\left(\frac{\partial V}{\partial p}\right)_T$$

7. $$(\partial G)_A = -(\partial A)_G = S\left[V + p\left(\frac{\partial V}{\partial p}\right)_T\right] + pV\left(\frac{\partial V}{\partial T}\right)_p$$

VIII. Gibbs Free Energy

1. $(\partial p)_G = -(\partial G)_p = S$

2. $(\partial T)_G = -(\partial G)_T = V$

3. $(\partial V)_G = -(\partial G)_V = \left[V\left(\frac{\partial V}{\partial T}\right)_p + S\left(\frac{\partial V}{\partial p}\right)_T \right]$

4. $(\partial S)_G = -(\partial G)_S = \frac{V}{T}C_p - S\left(\frac{\partial V}{\partial T}\right)_p$

5. $(\partial U)_G = -(\partial G)_U = V\left[C_p - p\left(\frac{\partial V}{\partial T}\right)_p \right] - S\left[T\left(\frac{\partial V}{\partial T}\right)_p + p\left(\frac{\partial V}{\partial p}\right)_T \right]$

6. $(\partial H)_G = -(\partial G)_H = V[C_p + S] - TS\left(\frac{\partial V}{\partial T}\right)_p$

7. $(\partial A)_G = -(\partial G)_A = -S\left[V + p\left(\frac{\partial V}{\partial p}\right)_T \right] - pV\left(\frac{\partial V}{\partial T}\right)_p$