

3. The van der Waals gas has an equation for the internal energy of

$$u = c_v T - \frac{a}{v} + u_0 \quad (1)$$

where u_0 is a constant and each extensive term has been expressed in molar specific form.

(a) Show that

$$c_P - c_v = \frac{R}{1 - \frac{2a(v-b)^2}{RTv^3}} \quad (2)$$

(b) Evaluate $c_P - c_v$ for a pure He van der Waals gas when $v = 4.65 \times 10^{-4}$ m³/mole and $T = 298$ K and compare it to that of an ideal gas.