

## Answer on Question #55590 - Chemistry - General chemistry

### Question:

A 1.0 mole sample of an ideal monatomic gas at 10.0 °C undergoes a reversible adiabatic expansion from 2.94 to 3.68 L. Determine  $\Delta T$ ,  $\Delta U$ ,  $\Delta S$ ,  $w$ , and  $q$ .

### Solution:

For a monatomic ideal gas :

$$C_p = \frac{5}{2}R$$

$$C_p = \frac{5}{2}8,314 = 20.785$$

$$C_v = \frac{3}{2}R$$

$$C_v = \frac{3}{2}8,314 = 12,471$$

$$k = \frac{C_p}{C_v}$$

$$k = 1,667$$

Since expansion is adiabatic :

$$q = 0$$

$$Q = 0$$

For ideal gas with adiabatic and reversible process and constant specific heats, you have the following :

$$PV^k = P_1V_1^{1.667}$$

$$TV^{k-1} = T_1V_1^{0.667}$$

$$T_2 = T_1 * \frac{V_1^{0.667}}{V_2}$$

$$T_2 = 243.64$$

$$\Delta U = C_v(T_2 - T_1)$$

$$\Delta U = 12,471(243.64 - 283)$$

$$\Delta U = -490,86$$

$$\Delta T = -39.36$$

$$w = q - \Delta U$$

$$w = 0 + 39,36$$

$$w = 39,36$$

$$\Delta S = 0$$