

Physics 102Rec
Quiz#3
Chapter 20

Name: Key Id: _____ Sect: _____

One mole of an ideal gas is compressed isothermally to a final pressure of 5 atm and a volume of 10 liters. The work done on the gas during the process is 4000 J. Determine the initial volume of the gas.

$$\text{isothermal process} \Rightarrow W = nRT \ln\left(\frac{V_f}{V_i}\right)$$

$$W = -4000 \text{ J} \text{ because the gas is compressed}$$

$$\ln\left(\frac{V_f}{V_i}\right) = \frac{W}{nRT} = \frac{W}{P_f V_f} \quad (nRT = P_i V_i = P_f V_f)$$

$$\frac{V_f}{V_i} = e^{\frac{W}{P_f V_f}}$$

$$V_i = V_f e^{-\frac{W}{P_f V_f}}$$

$$V_i = 10 e^{-\frac{-4000}{(5 \times 1.01 \times 10^5)(10 \times 10^{-3})}} = \underline{\underline{22 \text{ L}}}$$