

Physics 102  
Quiz # 4  
Chapter 20

Name: Solution

Id: \_\_\_\_\_

Sec. #: \_\_\_\_\_

Consider 100 g of helium (He) gas at 77 K. How much heat energy must be supplied to the gas to increase its temperature to 24 degrees-C, if the process is isovolumetric? (Molar mass of He = 4 g/mole)

$$T_f = 24 + 273 = 297 \text{ K}$$

$$\Delta T = 297 - 77 = 220 \text{ K}$$

Now

$$\Delta E_{\text{int}} = n C_v \Delta T$$

$C_v$  for monatomic gas is  $\frac{3}{2} R$

$$n = \frac{m}{M} = \frac{100 \text{ g}}{4 \text{ g/mol}} = 25 \text{ mol}$$

$$\Rightarrow \Delta E_{\text{int}} = n C_v \Delta T$$

$$\Rightarrow \Delta E_{\text{int}} = 25 \times \frac{3}{2} \times 8.31 \times 220$$

$$\Rightarrow \Delta E_{\text{int}} = 6.9 \times 10^4 \text{ J}$$