$P \cdot V = n \cdot R \cdot T$

a) $(1.2 \times 10^5 \text{ Pa})(24 \times 10^{-3} \text{ m}^3) = (1)(8.31 \text{ J/mol K}) \cdot T_A$

$$T_A = 347 \text{ K}$$

b) $(1.2 \times 10^5 \text{ Pa})(72 \times 10^{-3} \text{ m}^3) = (1)(8.31 \text{ J/mol K}) \cdot T_B$

$$T_B = 1040 \text{ K}$$

c) $T_A = T_C$ (isothermal Process)

$$T_C = 347 \text{ K}$$

d) $\Delta KE = \frac{3}{2} \cdot k_B \cdot \Delta T$ or $\Delta U = \frac{3}{2} \cdot n \cdot R \cdot \Delta T$

$\Delta U_{AB} = \frac{3}{2} \cdot (1)(8.31 \text{ J/mol} \cdot \text{K})(1040 \text{ K} - 347 \text{ K})$

$$\Delta U_{AB} = +8635 \text{ J}$$

e) $\Delta U_{BC} = \frac{3}{2}(1)(8.31 \text{ J/mol} \cdot \text{K})(347 \text{ K} - 1040 \text{ K})$

$$\Delta U_{BC} = -8635 \text{ J}$$