20.5

Datos

$P_c = 1.5\ atm \Rightarrow 1.515 \cdot 10^5\ Pa$

$n = 0.25\ mol$

$\gamma = 1.4$

$V_c = 0.002\ m^3$

$V_a = 0.002\ m^3$

$V_b = 0.009\ m^3$

Para un Proceso adiabatico

$$P_a V_a^{\gamma} = P_b V_b^{\gamma}$$

$$P_a = P_b \left(\frac{V_b}{V_a}\right)^{\gamma} = 1.515 \cdot 10^5 \left(\frac{0.009}{0.002}\right)^{1.4}$$

$$P_a = 12.4 \cdot 10^5\ Pa$$

Para la cantidad de calor debemos conocer las temperaturas en los estados finales e iniciales y tambien Cv.

Como $\gamma = \frac{C_P}{C_V}$ $\quad C_V \gamma = C_P = C_V + R$

$$C_V \gamma = C_V + R$$

$$C_V \gamma - C_V = R$$

$$C_V(\gamma - 1) = R$$

$$C_V = \frac{R}{\gamma - 1} = \frac{8.31}{1.4-1} = \frac{8.31}{0.4} = 20.775\ J/K$$

$$T_a = \frac{P_a V_a}{nR} = \frac{(12.4 \cdot 10^5)(0.002)}{(0.25)(8.31)} = 1193.7\ K$$

$$T_c = \frac{P_c V_c}{nR} = \frac{(1.515 \cdot 10^5)(0.002)}{(0.25)(8.31)} = 145.8\ K$$

$$Q_{ca} = n c_v \Delta T$$

$$Q_{ca} = (0.25)(20.775)(1173.7 - 145.8)$$

$$Q_{ca} = (0.25)(20.775)(1027.9)$$

$$Q_{ca} = 5338.6 \text{ J}$$

Se cede en el proceso bc

$$T_b = \frac{P_b V_b}{nR} = \frac{(1.515 \cdot 10^5)(0.009)}{(0,25)(8.31)} = 656.3 \text{ K}$$

$$Q = n c_p \Delta T = (0.25)(29.08)(145.8 - 656.3)$$

$$Q = -3711.3 \text{ J}$$

$$W = Q_{abs} - Q_{ced}$$

$$W = 5338 - 3711.3 = 1626.7 \text{ J}$$

$$\eta = 1 - \frac{Q_{ced}}{Q_{ab}} = 1 - \frac{3711.3}{5338.6} = 0.3$$