QUESTION 1 - SOLUTION:

State 1:	State 2:
P_1	P_2
$T_1 = 25°C = 298\ K$	$T_2 = 500\ K$
$V_1 = 0,8\ m^3$	$V_1 = V_2 = 0,8\ m^3$

$m_{air} = 5,2\ kg$

$R_{air} = 0,287\ kJ/kg \cdot K$

A) From the gas perfect law for state 1:

$$P_1 \cdot V_1 = m \cdot R \cdot T_1 \Rightarrow P_1 \cdot 0,8\,[m^3] = 5,2\,[kg] \cdot 0,287\left[\frac{kJ}{kg \cdot K}\right] \cdot 298\,[K]$$

$$\Rightarrow P_1 = \frac{5,2 \cdot 0,287 \cdot 298\ [kJ]}{0,8\ [m^3]} = 555,92 \cdot \frac{kJ}{m^3} =$$

$$= 555,92 \cdot 10^3 \frac{m^3 \cdot Pa}{m^3} \Rightarrow \boxed{P_1 = 5,56\ bar}$$

B) The ideal gas equation for states 1 & 2 are written below

$$\left.\begin{array}{l} \text{State 1: } P_1 \cdot V_1 = m R T_1 \\ \text{State 2: } P_2 \cdot V_2 = m R T_2 \end{array}\right\} \frac{①}{②} \Rightarrow \frac{P_1 \cdot V_1 = m R T_1}{P_2 \cdot V_2 = m R T_2} \Rightarrow \frac{P_1}{P_2} = \frac{T_1}{T_2} \Rightarrow$$

$$P_2 = \frac{P_1 \cdot T_2}{T_1} = 5,56\,[bar] \cdot \frac{500}{298} = \boxed{9,33\ bar}$$

C) The work done in the process $W = \int_{V_1}^{V_2} P \cdot dV = P[V_2 - V_1]$

$$\Rightarrow \boxed{W = 0}$$

QUESTION 2 - SOLUCIÓN:

The work during a polytropic process is given by:

$$W = \frac{P_2 \cdot V_2 - P_1 \cdot V_1}{1-n} \quad (1)$$

From the ideal gas law for state 1:

$$P_1 \cdot V_1 = m R T_1 \Rightarrow m \cdot R = \frac{P_1 \cdot V_1}{T_1} = \frac{400 \cdot 10^3 Pa \cdot 0{,}3\, m^3}{383\, K} \Rightarrow$$

$$m \cdot R = \frac{120 \cdot 10^3 [Pa \cdot m^3]}{383\, K} = \frac{120\, kJ}{383\, K} = \boxed{0{,}313 \left[\frac{kJ}{K}\right]}$$

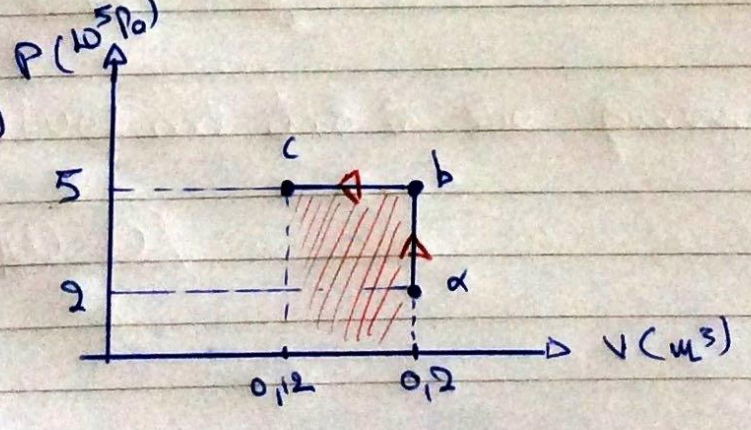
From equation (1) $W = \frac{P_2 V_2 - P_1 V_1}{1-n} \Rightarrow W = \frac{m R T_2 - m R T_1}{1-n} \Rightarrow$

$$W = \frac{m \cdot R\,[T_2 - T_1]}{1 - 1{,}2} = \frac{0{,}313 \left[\frac{kJ}{K}\right] \cdot [673 - 383]\,[K]}{-0{,}2} \Rightarrow$$

$$\boxed{W = -453{,}85\ kJ}$$

QUESTION 3 - SOLUCIÓN:

A)



B) The work done during process ab: $W_{ab} = 0$ [Isochoric Process]

The work done during process bc: $W_{bc} = P \cdot dV = P \cdot [V_c - V_b] \Rightarrow$

$$\Rightarrow W_{bc} = 5 \cdot 10^5 [Pa] \cdot [-0{,}08]\, m^3 \Rightarrow \boxed{W_{bc} = -4 \cdot 10^4\ J}$$

Total Work: $W_{ab} + W_{bc} = \boxed{-4 \cdot 10^4\ J}$