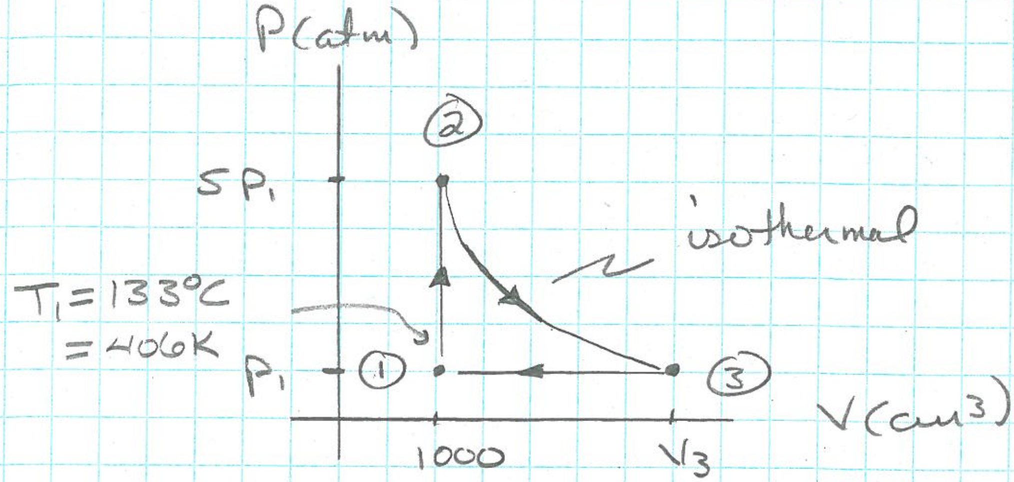

$M = 120$ mg of He (monatomic), $M_{mol} = .004 \frac{kg}{mole}$

So: $n = \frac{120 \times 10^{-6} \text{ kg}}{.004 \text{ kg/mol}} = 0.03$ moles

a.) at ①: $T_1 = 406$ K, $V_1 = 1000 \times 10^{-6}$ m^3

$PV = nRT \Rightarrow P_1 = \frac{nRT_1}{V_1} = 1.0126 \times 10^5$ Pa
$= 1.0$ atm.

at ②: $V_2 = V_1$; $P_2 = 5P_1 = 5.065 \times 10^5$ Pa

$PV = nRT \Rightarrow T_2 = \frac{P_2 V_2}{nR} = 2031$ K $= 1758$°C

at ③: $T_3 = T_2$, $P_3 = P_1 = 1.013 \times 10^5$ Pa

$PV = nRT \Rightarrow V_3 = \frac{nRT_3}{P_3} = 5 \times 10^{-3}$ m^3
$= 5000$ cm^3

So:

	P	T	V
1	1.0 atm 1.013×10^5 Pa	133°C 406K	1000 cm^3
2	5.0 atm 5.065×10^5 Pa	1758°C 2031K	1000 cm^3
3	1.0 atm	1758°C 2031K	5000 cm^3

b & c.) I do this by starting at point ① and going around the cycle calculating the Q's and W's for each segment.

① → ② Constant Volume:

$W = \underline{0}$

$Q = nC_v \Delta T = nC_v(T_2 - T_1)$

$= \underline{609.4\ J}$

Monatomic: $C_v = 12.5\ \frac{J}{mol K}$

② → ③ Isothermal: $\Delta E_{th} = 0$

$\Delta E_{th} = Q + W = 0 \Rightarrow Q = -W$

and,

$W = -nRT_2 \ln\left(\frac{V_3}{V_1}\right) = \underline{-815.3\ J}$

and $Q = \underline{815.3\ J}$

③ → ① Constant Pressure

$W = -P\Delta V = -P_1(V_1 - V_3) = \underline{405.2\ J}$

$Q = nC_p \Delta T = nC_p(T_1 - T_3)$

$= -\underline{1014\ J}$

$C_p = 20.8\ \frac{J}{mol K}$