(ii) GIVEN

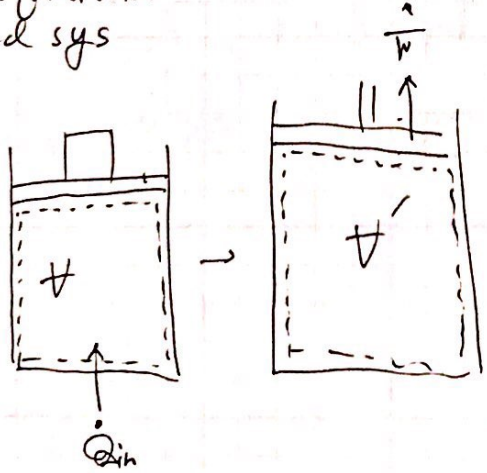
Piston-cylinder
>> shaft cross-sectional Area = $A = 0.8\ cm^2 = 0.8\times10^{-4}\ m^2$
>> diameter of piston top $D = 10\ cm = 0.1\ m$
>> piston-shaft mass $\equiv m = 25\ kg$
>> *(heated slowly) internal E/K increase $\Delta U = 0.1\ kJ$
* PE increase $\Delta PE = 0.2\ kJ$
* force $\equiv F = 1334\ N$ exerted on shaft
>> piston poor conductor & no friction
>> $g = 9.81\ m/s^2$, $P_{atm} = 1\ bar = 1\times10^5\ Pa$

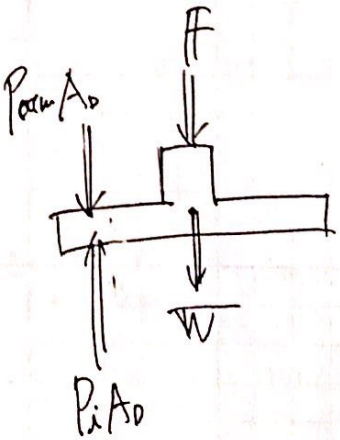
FIND
(a) the work done by shaft (kJ)
(b) work done in displacing atmosphere (kJ)
(c) $\dot{Q}$ to gas (kJ)

EQN
$$\frac{dE}{dt}_{sys} = \sum_{in}\dot{m}_{in}(u+KE+PE)_{in} - \sum_{out}\dot{m}_{out}(h+KE+PE)_{out} + \dot{Q} - \dot{W}$$

Assump
- Quasiequilibrium
- frictionless
- closed sys

EFD





SOLN
$$\Delta PE = mg\Delta h$$
$$\therefore \Delta h = (0.2\times10^3\ J)/(25\ kg)(9.81\ \tfrac{m}{s^2}) \cong 0.8155\ m \cong 0.816$$