ME/CH EN 2300
Homework # 5
Due Wednesday, Feb. 14

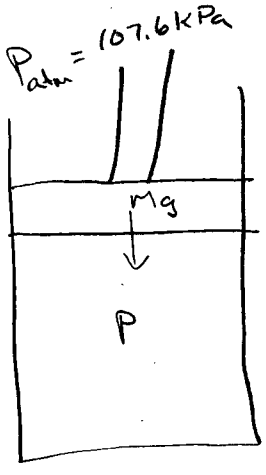
Note: Please list which section of the class you are in (ME EN or CH EN) on your assignment

1. (3-31, Numbers modified) A piston cylinder device contains 0.85 kg of refrigerant 134a at –10C. The piston that is free to move has a mass of 12 kg and a diameter of 25 cm. The local atmospheric pressure is 107.6 kPa. Now heat is transferred to the refrigerant until the temperature is 20C.

a) What is the final pressure in the cylinder

b) What is the change in volume of the refrigerant in the cylinder?

c) What is the change in enthalpy of the refrigerant in the cylinder?



$$P = P_{atm} + Mg/A$$

$$= 107600\ Pa + \frac{(12\ kg)(9.81\ m/sec^2)}{\left(\frac{.25}{2}\right)^2 \pi}$$

$$= 107600\ Pa + 2398\ Pa$$

$$= 110{,}000\ Pa = \boxed{110\ kPa} \quad A$$

B) Figure out state of fluid

@ –10C Sat Pressure is 200.7 KP. We are @ 110 kPa so we must be in superheated vapor state.

From table A-13, interpolating between .1 MPa and .14 MPa @

–10 C:

gives $v = .1614\ m^3/kg$ → (interpolating between .20743 & .14605 m^3/kg

& $h = 246.6\ KJ/kg$ → " " 247.49 & 246.36 KJ/kg

For 20 C gives $v = .1825\ m^3/kg$ → " " .23373 & .16544

& $h = 271.6$ → " " 272.17 & 271.38

So $\Delta v = .1825 - .1614 = .0211\ m^3/kg$

$\Delta h = 271.6 - 246.6 = 25\ KJ/kg$