24-221
Thermodynamics

Solution to: Quiz 1
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Given: Piston cylinder assembly
Gas Pressure P_g = 200 kPa
Area of cross section A: 0.01m^2
Mass of the piston m_p = 50 kg
External Pressure P_0

To Find: P_0 such that it just keeps the piston from resting on the stops

Solution: To keep the piston from resting on the stops P_0 should be such that there is mechanical equilibrium on the piston

i.e. Force acting downwards = Force acting upwards

$P_0A + m_pg = P_gA$

Dividing by A we get

$P_0 + (m_pg/A) = P_g$

(or) $P_0 = P_g - (m_pg/A) = 200*10^3 – (50*9.807/0.01) = 150965$

P_0 = 150.965 kPa ---------- Answer