

[tex170] **Heavy piston II**

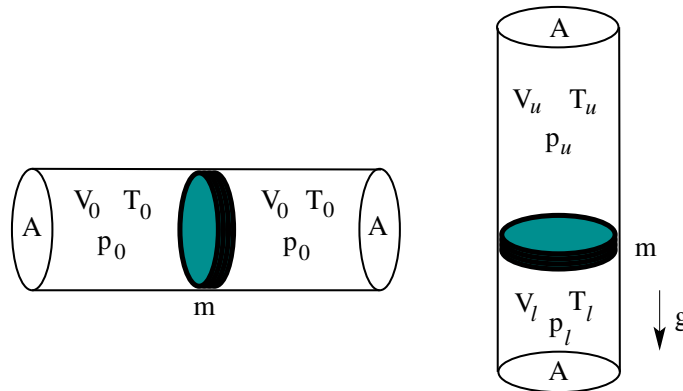
A cylinder of cross section A has two compartments separated by a mobile disk of mass m positioned in the middle as shown. Each compartment has volume V_0 and contains $n = 1\text{mol}$ of a classical monatomic ideal gas at temperature T_0 . When the axis of the cylinder is tilted into a vertical orientation the disk equilibrates in a different position owing to the effect of a uniform gravitational field g . Find the volume V_u , the pressure p_u , and the temperature T_u in the upper compartment as well as the volume V_l , the pressure p_l , and the temperature T_l in the lower compartment under three different circumstances:

- (a) The cylinder has conducting walls and is immersed in a heat bath at temperature T_0 ;
- (b) the cylinder has insulating walls but the piston is heat conducting;
- (c) the cylinder walls and the piston are insulating.

It suffices to state the six equations that determine the six variables p_u, V_u, T_u and p_l, V_l, T_l in each of the three cases (a), (b), and (c), respectively. The heat capacities of the piston and the cylinder walls are assumed to be negligible.

Reason physically (as opposed to mathematically) in answering parts (d) and (e).

- (d) Is the piston in state (b) lower or higher than in state (c)?
- (e) Is the piston in state (b) lower or higher than in state (a)?



Solution: