

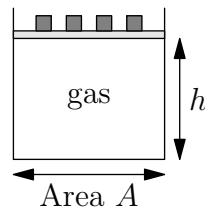
## J00T.2—Masses on a Piston of Gas

### Problem

An absent-minded physicist has a container of gas, but has forgotten whether it is Argon (Ar) or Nitrogen (N<sub>2</sub>).

An experiment is performed using a piston of area  $A$  and some small masses which are slowly placed on top of the piston one by one, as shown in the figure. The weight of the piston is negligible. The walls are insulating and the gas is ‘ideal’.

(adiabatic piston & walls)



The system is initially at rest, without masses on the piston. As the masses are added the height  $h$  is measured; the following relation is observed to describe the total masses as a function of piston height:

$$M_0 + M(h) \propto h^{-n},$$

where  $M_0$  is a constant.

If the gas were N<sub>2</sub> what would the exponent  $n$  be? What is  $M_0$ ?