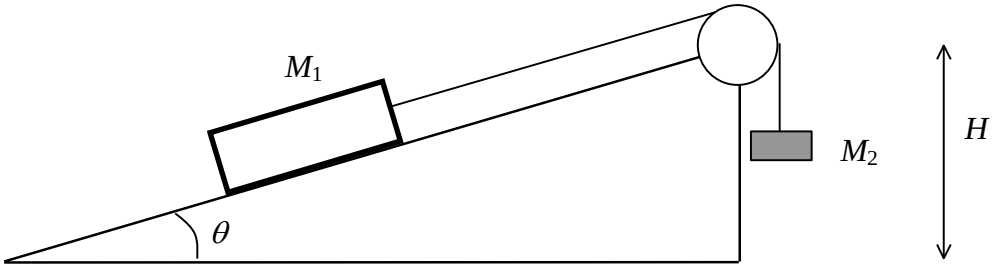
1) A block, of mass M_1, on the rough slope shown is attached to another mass M_2 by a light, inextensible string which passes over a frictionless pulley as shown in the diagram (the coefficient of friction between the block and the slope is μ). The block is released from rest. Find an expression for the height of the block above the bottom of the slope as a function of time. (You should consider the full range of behaviour that may happen for different values of the parameters).



2) A piston slides within a cylinder, of radius 1m, as shown in Figure 2. The volume of air trapped by the piston in the cylinder is 3 cubic metres and is at 600° C and 2 bar. The piston is released and the air in the cylinder heated so that, during the subsequent expansion, the temperature remains constant. How much work would be done against any load applied at P during the expansion process ?

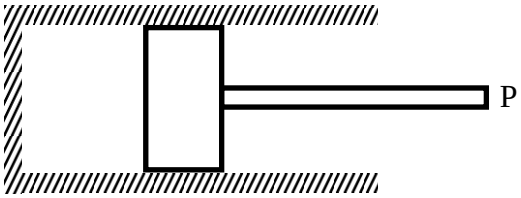


Figure 2

3) A constant voltage V_0 is applied to the circuit shown which contains two resistors, a multi-way switch and a capacitor. Initially open, the switch is closed to the left for a time T and then closed to the right for a further time T, before being set to open. Express the voltage V_c across the capacitor as a function of time.