A disk of radius $R$ is attached to a wall through a spring whose spring constant is $k$ (see the figure below). In addition, a rectangular block of width $a$ is positioned symmetrically on top of the disk. We assume that both the disk and the block roll without slip.

(a) Derive the potential energy of this mechanical system.
(b) Use the potential energy to deduce conditions under which the initial symmetric position of the block is stable.