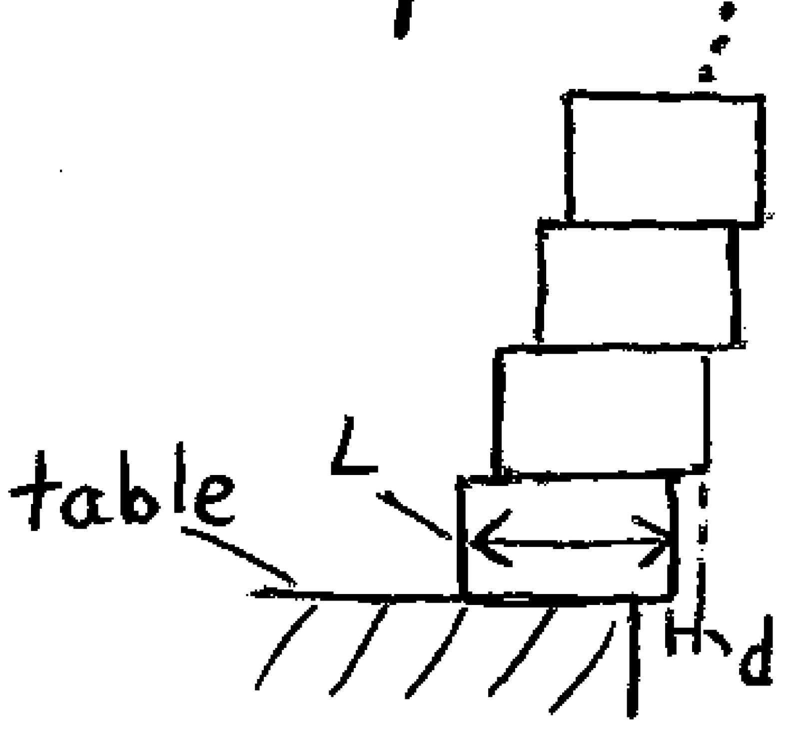
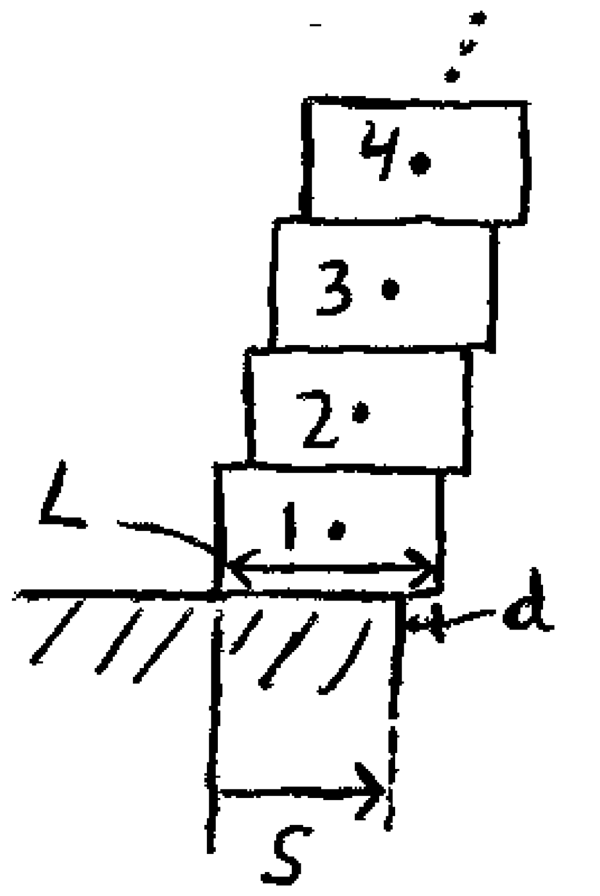
This is a problem involving statics.




Identical blocks of length L are placed on top of each other. Each block extends a distance d beyond the one underneath, and the bottom block also extends a distance d beyond the edge of the table. What is the maximum number of blocks that can be stacked?

Solution:




The center of mass of the stack of blocks cannot extend beyond the edge of the table.

The location of the center of mass of each block is in the center of each block (assuming they are uniformly dense throughout).

Calculate the (horizontal) location of the center of mass of the stack of blocks using the edge of the table as the reference point, and take the leftward direction as positive.

Then,

$$M r_{cm} = r_1 m_1 + r_2 m_2 + r_3 m_3 + \cdots$$

$$\Rightarrow r_{cm} = \frac{\left(\frac{L}{2} - d\right)m_1 + \left(\frac{L}{2} - 2d\right)m_2 + \left(\frac{L}{2} - 3d\right)m_3 + \cdots}{M}$$

where $m_1 = m_2 = m_3 \cdots = m$

and $M = m_1 + m_2 + m_3 + \cdots$

$$\Rightarrow r_{cm} = \frac{\left(\frac{L}{2} - d\right)m + \left(\frac{L}{2} - 2d\right)m + \left(\frac{L}{2} - 3d\right)m + \cdots}{m_1 + m_2 + m_3 + \cdots}$$

$r_{cm} = 0$ is the limiting case where the center of mass of the stack of blocks is directly above the edge of the table. If the center of mass was any further to the right, the blocks would fall.

$$\Rightarrow 0 = N\left(\frac{L}{2}\right) - d(1 + 2 + 3 + \cdots + N)$$

where $N$ is the number of blocks.

$$\Rightarrow 0 = N\left(\frac{L}{2}\right) - d\,\frac{N(N+1)}{2}$$

$$\Rightarrow 0 = L - d(N+1)$$

(answer)

$$N = \frac{L}{d} - 1$$

Since this may not be an integer, use the largest (integer) number of blocks less than or equal to $\frac{L}{d} - 1$.