Answer on Question#54192 - Physics - Mechanics - Kinematics - Dynamics

A 4 kg block is kept on a smooth frictionless surface. Another block of mass $m = 2\text{kg}$ is kept above this block. The coefficient of friction between the two blocks $n = 0.5$. If the lower block ($M = 4\text{kg}$ block) is being pulled by $F = 24\text{N}$ force, find the force of friction acting between the two blocks.

Solution:

Let's suppose that the upper block is not sliding, then both blocks have the same acceleration which is equal

$$a = \frac{F}{M+m} = \frac{24\text{N}}{4\text{kg}+2\text{kg}} = 4\frac{\text{m}}{\text{s}^2}$$

For this to be true the force of friction must be smaller than it's critical value

$$F_c = m \cdot g \cdot n = 2\text{kg} \cdot 10\frac{\text{m}}{\text{s}^2} \cdot 0.5 = 10\text{N},$$

where $g = 10\frac{\text{m}}{\text{s}^2}$ – is the acceleration due to gravity. The force of friction in this case is equal to the inertial force

$$F_i = m \cdot a = 2\text{kg} \cdot 4\frac{\text{m}}{\text{s}^2} = 8\text{N}$$

Since $F_i < F_c$, the upper block isn't sliding and the force of friction is equal to the inertial force.

Answer: 8N.