Answer on Question #74798, Physics / Mechanics | Relativity

A) A 6.0 kg mass sits atop a larger 9.0 kg mass which itself sits on a horizontal table top. A third, 3.0 kg mass hangs vertically just barely touching the right face of the large mass. A massless inflexible string connects the hanging mass to the top mass passing over a frictionless pulley (P). All horizontal surfaces have coefficients of static and kinetic friction of 0.80 and 0.40 respectively. All vertical surfaces are frictionless.

There is a little tap directly down on the hanging mass, just enough to cause this block to slide. Assume this motion applies to parts 3, 4 and 5.

3) The 9.0 kg mass does not move. What is the acceleration of m2; tension now in the string?

Solution.

$F_{fr} = \mathrm{k} \cdot \mathrm{P} = \mathrm{k} \cdot \mathrm{mg}$

$F_{fr.m2} = 0{,}4 \cdot 6 \cdot 9{,}81 = 23{,}54\ N$

$F_{ten} = \mathrm{m} \cdot \mathrm{g}$

$F_{ten} = 3 \cdot 9{,}81 = 29{,}43\ N$

$F = F_{ten} - F_{fr.m2} = 29{,}43 - 23{,}54 = 5{,}89\ N$

$F = \mathrm{m} \cdot \mathrm{a}$

$a = \dfrac{F}{m} = \dfrac{5{,}89}{6} = 0{,}98\ \dfrac{m}{s^2}$

Answer: $F_{ten} = 29{,}43\ N\ ,\ a = 0{,}98\ \frac{m}{s^2}$

4) What is the magnitude of the net horizontal force on the pulley? What is the magnitude of net force on the support rod (S) by the pulley?

$F_{\text{net horizontal}} = F_{ten} - F_{fr.m2} = 29{,}43 - 23{,}54 = 5{,}89\ N$

$F_{\text{net force on the support rod (S) by the pulley}} = 2 \cdot F_{ten} \cdot \sin\dfrac{\propto}{2} = 2 \cdot 29{,}43 \cdot \sin\dfrac{90}{2} = 2 \cdot 29{,}43 \cdot 0{,}7 =$

= 41,2 N

Answer: $F_{\text{net horizontal}} = 5{,}89\ N$; $F_{\text{net force on the support rod (S) by the pulley}} = 41{,}2\ N$

5) What is the magnitude and direction of the total friction force on the large mass, if any, at the interface between the table top and this mass?

Answer: Total friction force on the large mass equals to zero.