Answer on Question #63936-Physics-Classical Mechanics

The blocks a and b are connected by a piece of string. Block b rests on an inclined plane of 40 and block a hangs vertically. The coefficient of friction between block b and the inclined plane is 0.29. Calculate the acceleration of the system if the mass of block a is 0.15 kg and that of block b is 7.5 kg

Solution

$$m_b a = m_b g - T$$

$$m_a a = T - m_a g \sin 40° - F_{fr}$$

$$F_{fr} = \mu N = \mu m_a g \cos 40°$$

So,

$$m_b a = m_b g - T$$

$$m_a a = T - m_a g \sin 40° - \mu m_a g \cos 40°$$

Add these tow equations:

$$(m_a + m_b)a = m_b g + m_a g \sin 40° - \mu m_a g \cos 40°$$

$$a = \frac{m_b - m_a \sin 40° - \mu m_a \cos 40°}{(m_a + m_b)} g = \frac{7.5 - 0.15 \sin 40° - 0.29 \cdot 0.15 \cos 40°}{(0.15 + 7.5)} 9.8 = 9.4 \frac{m}{s^2}.$$

Answer: $9.4 \frac{m}{s^2}.$