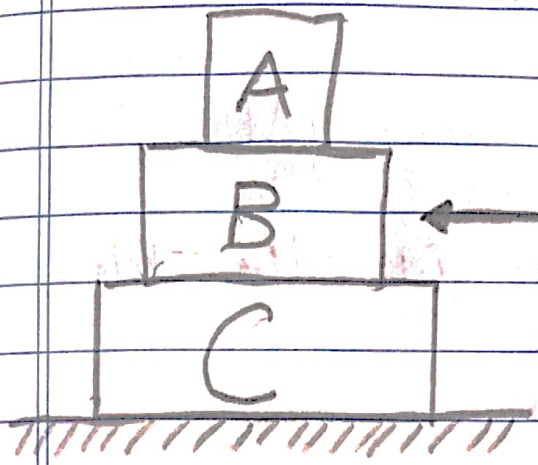
20-P-FA-BK-003

Date



given: $m_A = 1$, $m_B = 2$, $m_C = 3$

$\mu_{SGROUND}$, $\mu_{KGROUND}$

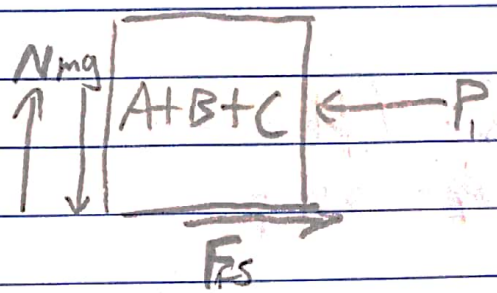
μ_{SBLOCK} μ_{KBLOCK}

P_1: entire system slides along ground

P_2: B slides against C, C slides along ground

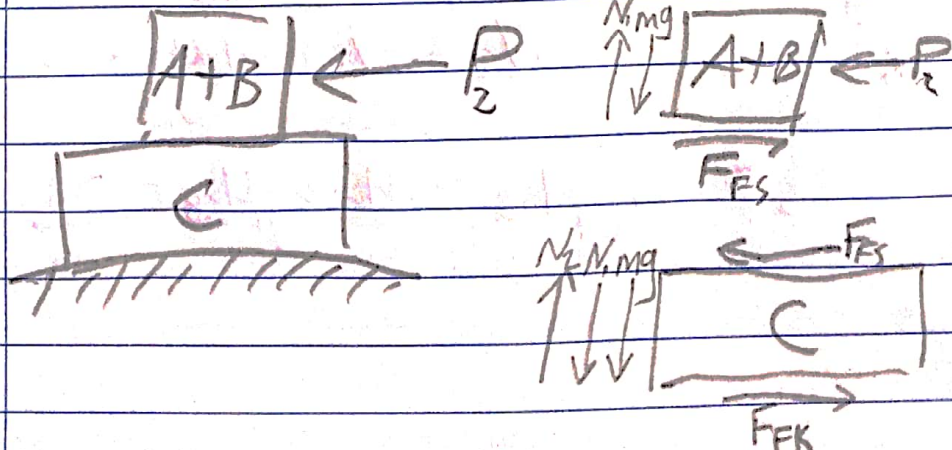
P_3: B slides against A & C, C slides along ground

P_1: analyze as one system.



$F_S = \mu_{SG} \cdot m_{A+B+C} \cdot g = P_1$

P_2: analyze as 2 systems



$N_1 = m_{A+B} g$

$F_{FS} = N_1 \mu_{SB}$

$N_2 = N_1 + m_C g$

$F_{FK} = N_2 \mu_{KG}$

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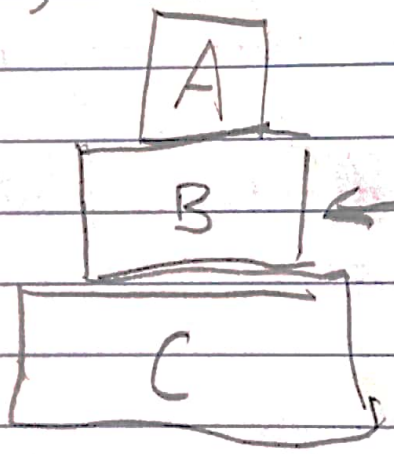
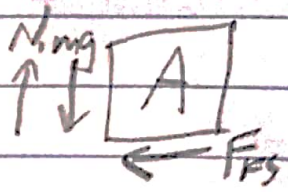
$$\Sigma F_{AB} = P_2 - m_{A+B} g \mu_{SB} = m_{A+B} \cdot a$$

$$\Sigma F_C = m_{A+B} g \mu_{SB} - m_{A+B+C} g \mu_{KG} = m_C a$$

$$P_2 = m_{A+B} g \mu_{SB} + \frac{m_{A+B}}{m_C} \left(m_{A+B} g \mu_{SB} - m_{A+B+C} g \mu_{KG} \right)$$

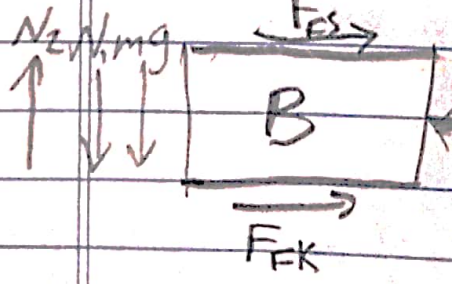
P_3: since we know from the question that B is already sliding past C, we only care when the force between A and B overcomes static friction. We don't need to analyze C.





$$F_{FS} = N_1 \mu_{SB} = m_A a$$

$$N_1 = m_A g$$



$$\Sigma F_B = P_3 - F_{FS} - F_{FK} = m_B a$$

$$F_{FS} = N_1 \mu_{SB}$$

$$F_{FK} = N_2 \mu_{KB}$$

$$N_2 = N_1 + m_B g = m_{A+B} g$$

$$P_3 = m_A g \mu_{SB} + m_{A+B} g \mu_{KB} + \frac{m_B}{m_A} \cdot m_A g \mu_{SB}$$