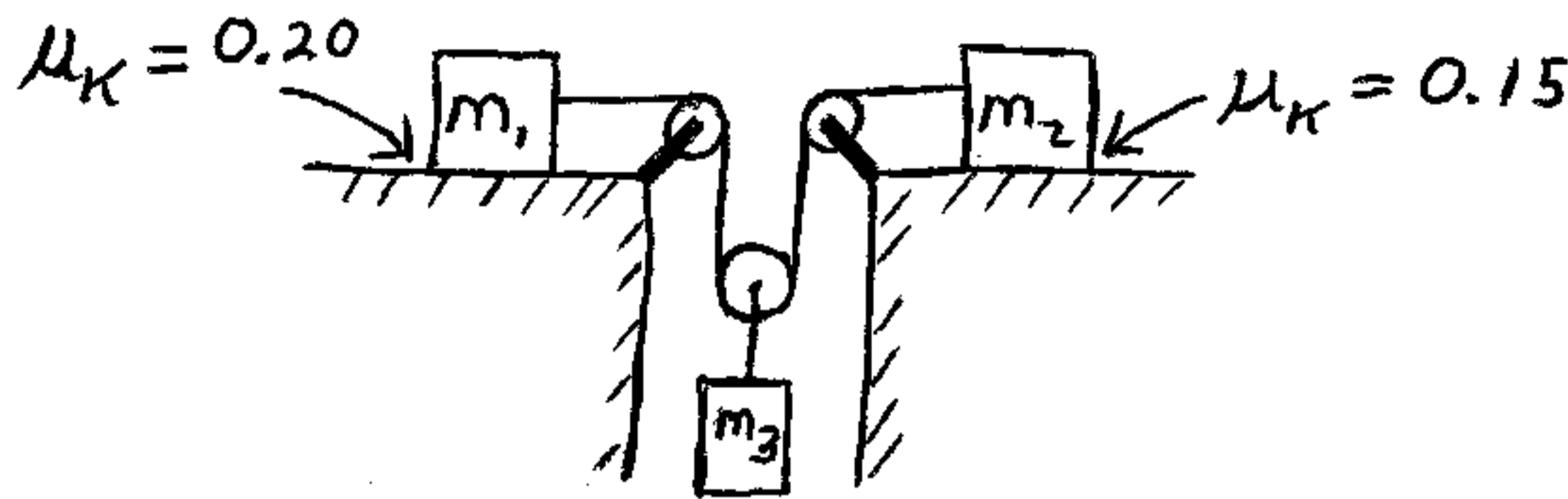


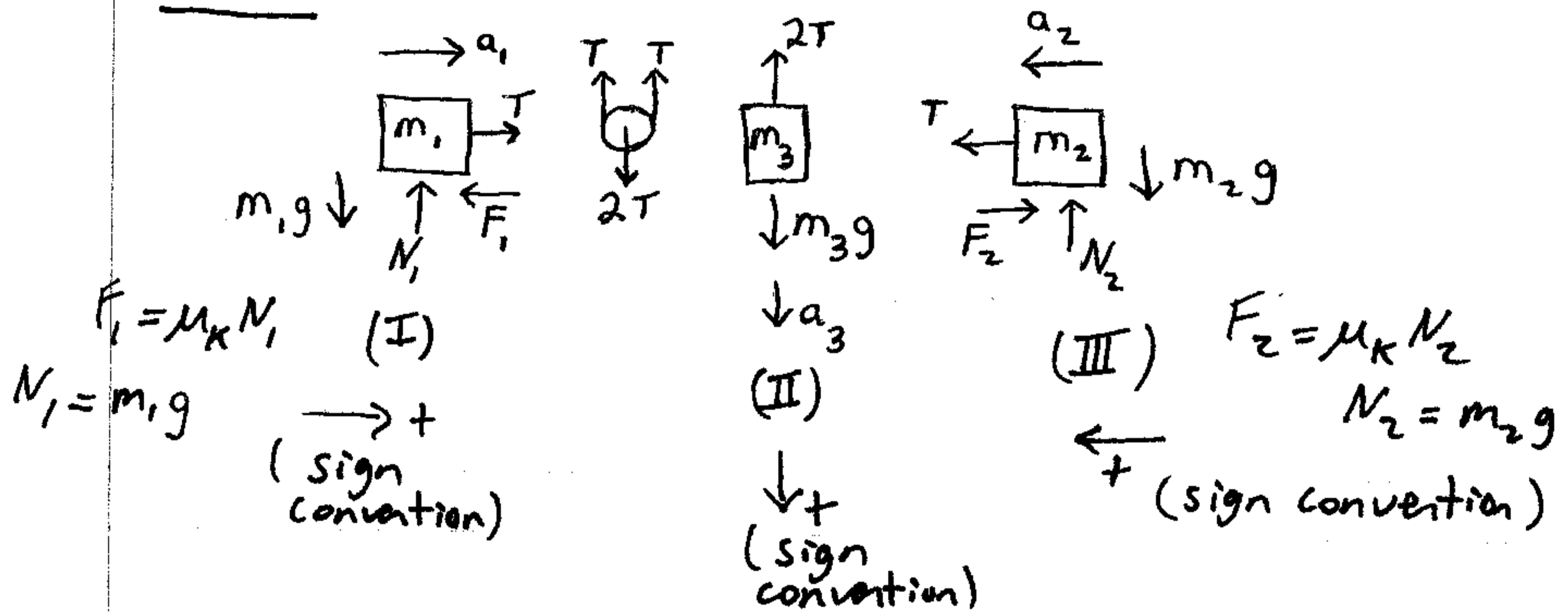
This is a force and motion problem involving friction.



In the pulley system shown,  $m_1 = 6 \text{ kg}$ ,  $m_2 = 13 \text{ kg}$ , and  $m_3 = 10 \text{ kg}$ . Determine the acceleration of each block and the tension in the rope.

Solution:

Free-body diagrams



From the kinematics,  $a_1 + a_2 = 2a_3$  (1)

(I) Apply Newton's second law:

$$T - F_1 = m_1 a_1 \Rightarrow T - 0.20 m_1 g = m_1 a_1 \quad (2)$$

(II) Apply Newton's second law:

$$m_3 g - 2T = m_3 a_3 \quad (3)$$

(III) Apply Newton's second law:

$$T - F_2 = m_2 a_2 \Rightarrow T - 0.15 m_2 g = m_2 a_2 \quad (4)$$

Combine equations (1)-(4) and solve:

$$a_1 = 4.0 \text{ m/s}^2$$

$$a_2 = 1.28 \text{ m/s}^2$$

$$a_3 = 2.64 \text{ m/s}^2$$

$$T = 35.78 \text{ N}$$

(answer)