

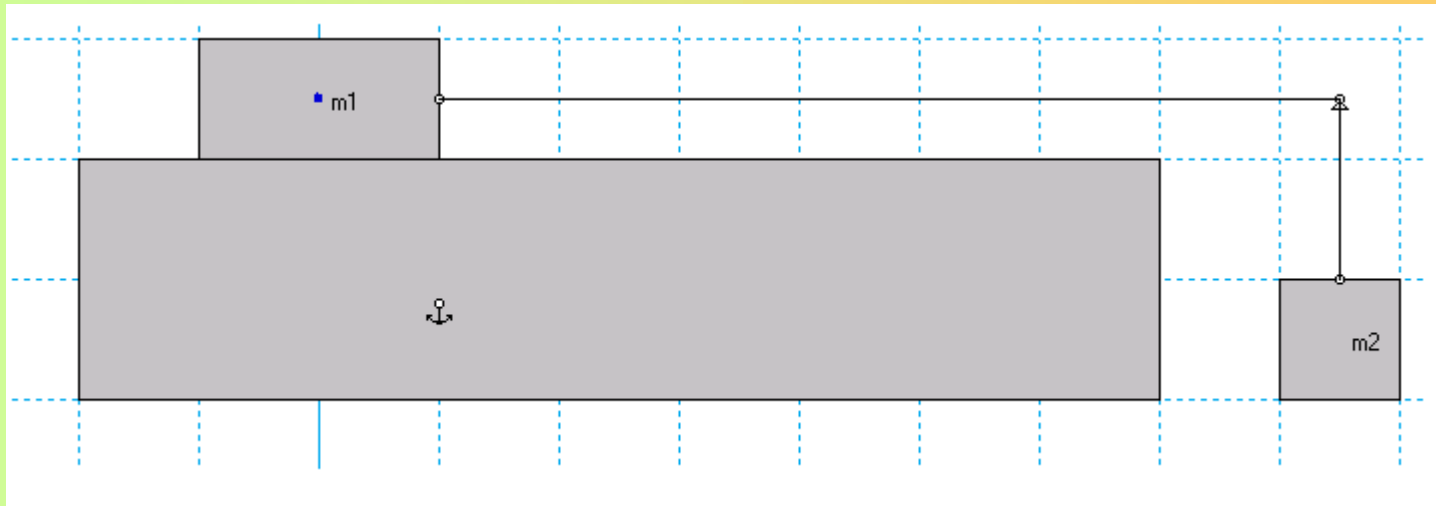
Horizontal plane: exercise

Problem

Given the horizontal plane below, calculate

- the acceleration of the system
- the tension

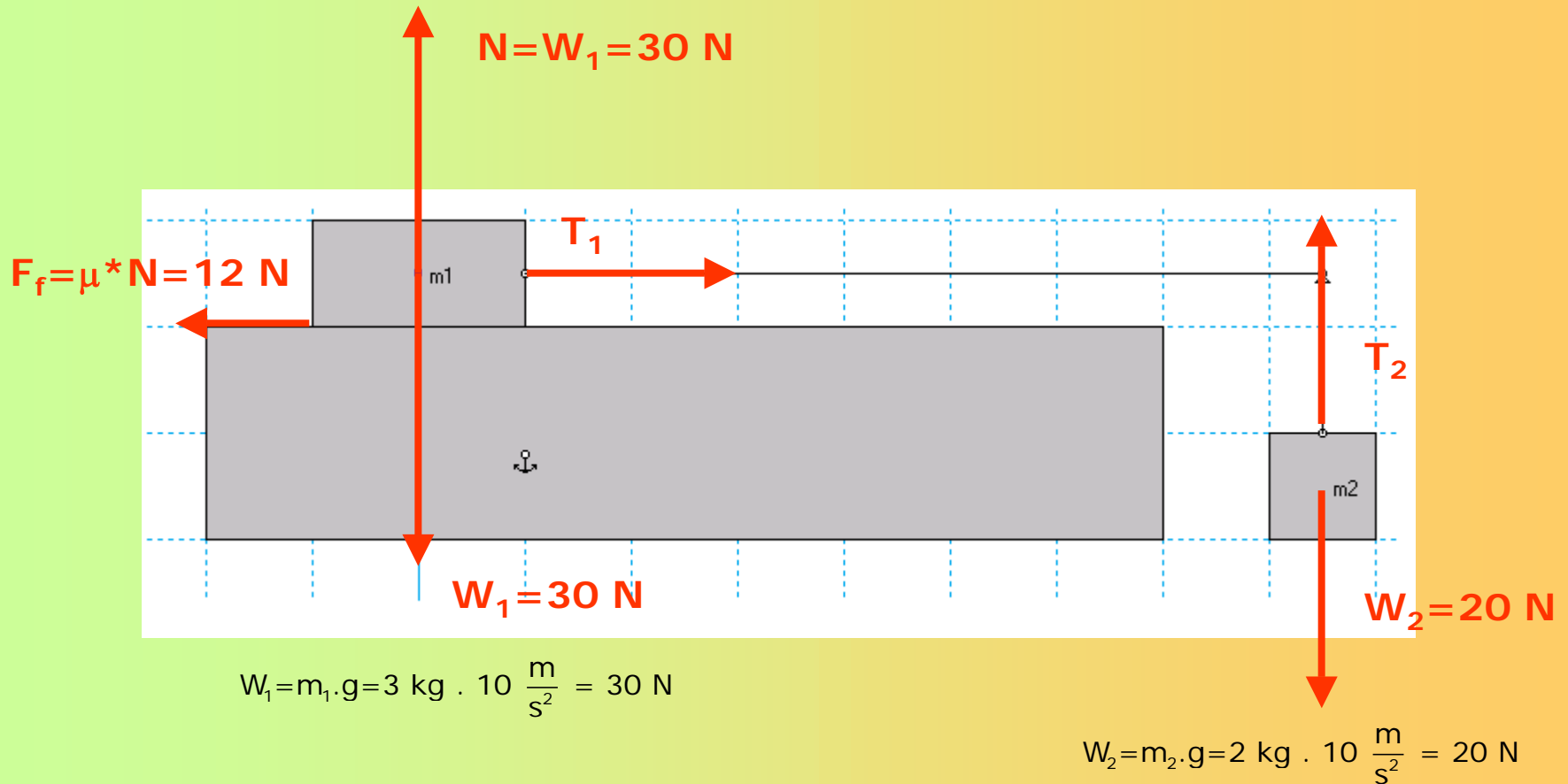
$$m_1=3 \text{ kg}; m_2=2 \text{ kg}; \mu=0.4$$



Horizontal plane: exercise

Solution

1) Let's draw the forces and calculate their values



Horizontal plane: exercise

Solution

2) Applying the 2nd law

The net vertical force is 0

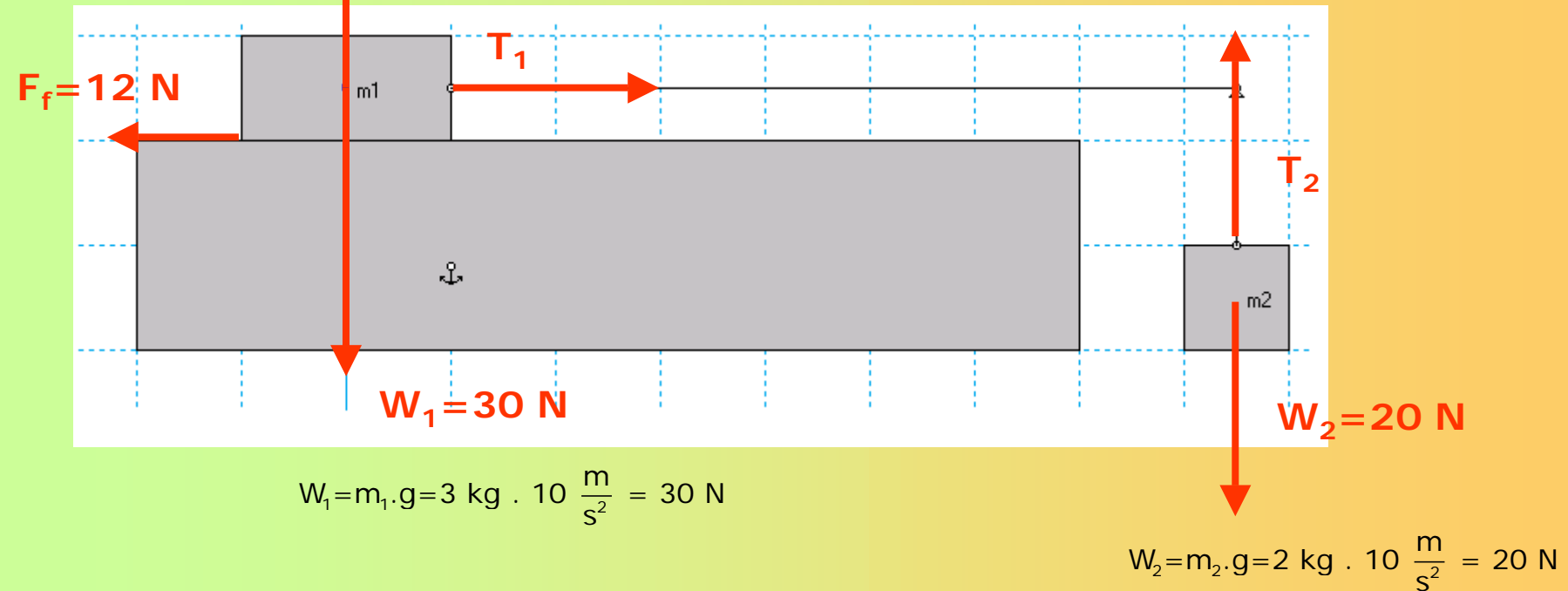
$$N = W_1 = 30 \text{ N}$$

Newton's equation:

$$m_T = 3 \text{ kg} + 2 \text{ kg} = 5 \text{ kg}$$

$$F_{\text{net}} = m_T \cdot a \rightarrow F_{\text{net}} = 20 \text{ N} - T_2 + T_1 - 12 \text{ N} = 8 \text{ N} \rightarrow 8 \text{ N} = 5 \text{ kg} \cdot a$$

$$a = \frac{8 \text{ N}}{5 \text{ kg}} = 1.6 \frac{\text{m}}{\text{s}^2}$$



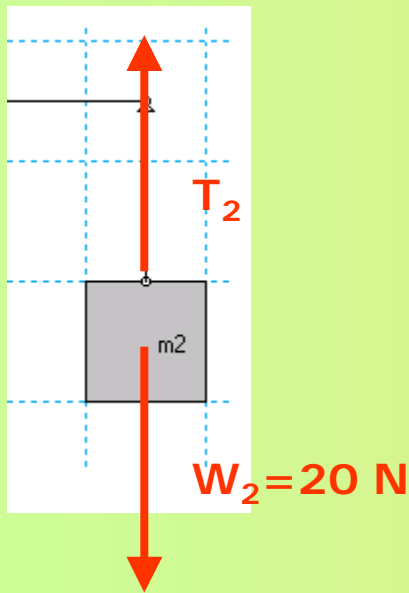
Horizontal plane: exercise

Solution

3) Applying the 2nd law to an isolate body

$$F_T = m \cdot a \rightarrow 20 \text{ N} - T_2 = 2 \text{ kg} \cdot 1.6 \frac{\text{m}}{\text{s}^2} = 3.2 \text{ N}$$

$$T_2 = 20 \text{ N} - 3.2 \text{ N} = 16.8 \text{ N} = T_1$$



$$W_2 = m_2 \cdot g = 2 \text{ kg} \cdot 10 \frac{\text{m}}{\text{s}^2} = 20 \text{ N}$$