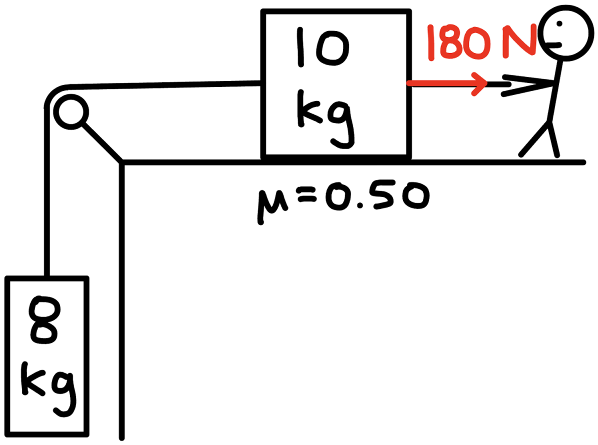
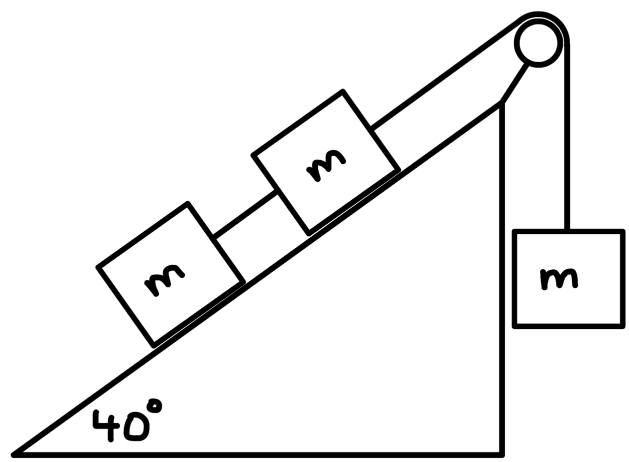
Determine the acceleration of the system and the tension in the rope connecting the masses

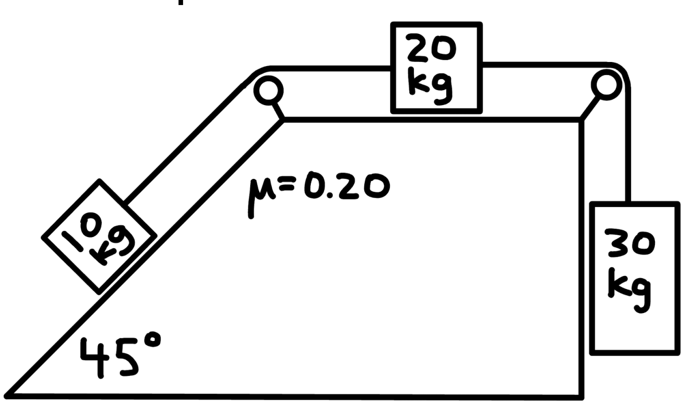


Determine the acceleration of the system if...

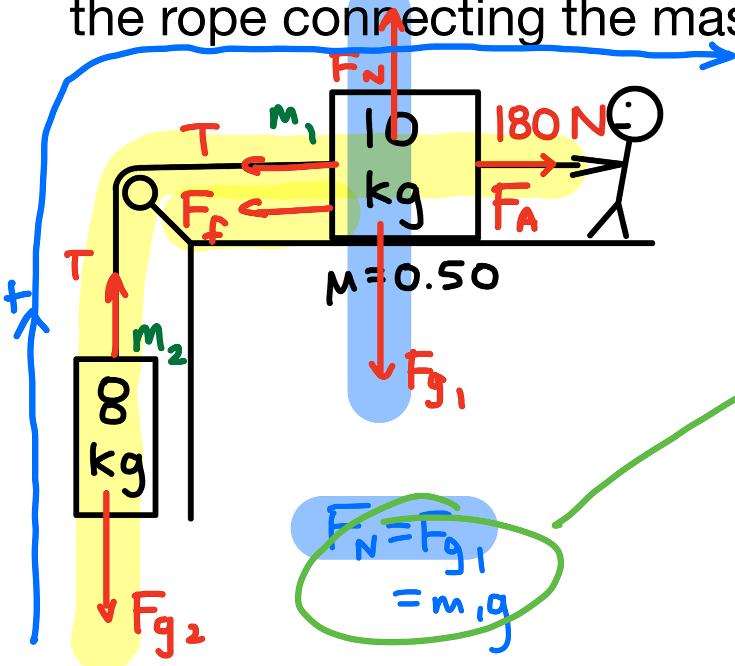
a) the slope is frictionless
b) the coefficient of friction is 0.1
c) the coefficient of friction is 0.3



Determine the acceleration of the system and the tension in each rope.



Determine the acceleration of the system and the tension in the rope connecting the masses



$$F_{NET} = Ma$$

$$F_A - F_f - \cancel{T} + \cancel{T} - F_{g_2} = Ma$$

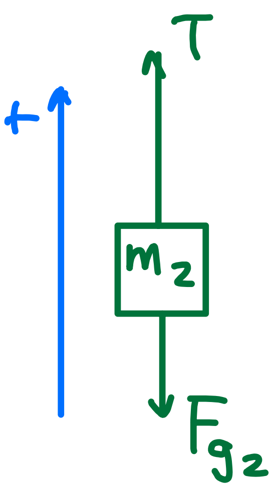
$$F_A - \mu F_N - m_2 g = Ma$$

$$F_A - \mu m_1 g - m_2 g = Ma$$

$$a = \frac{F_A - \mu m_1 g - m_2 g}{M}$$

$$= \frac{180 - (0.50)(10)(9.8) - (8)(9.8)}{18}$$

$$= \boxed{2.92 \ \frac{m}{s^2} \ \text{RIGHT}}$$



$$F_{NET} = m_2 a$$

$$T - F_{g_2} = m_2 a$$

$$T - m_2 g = m_2 a$$

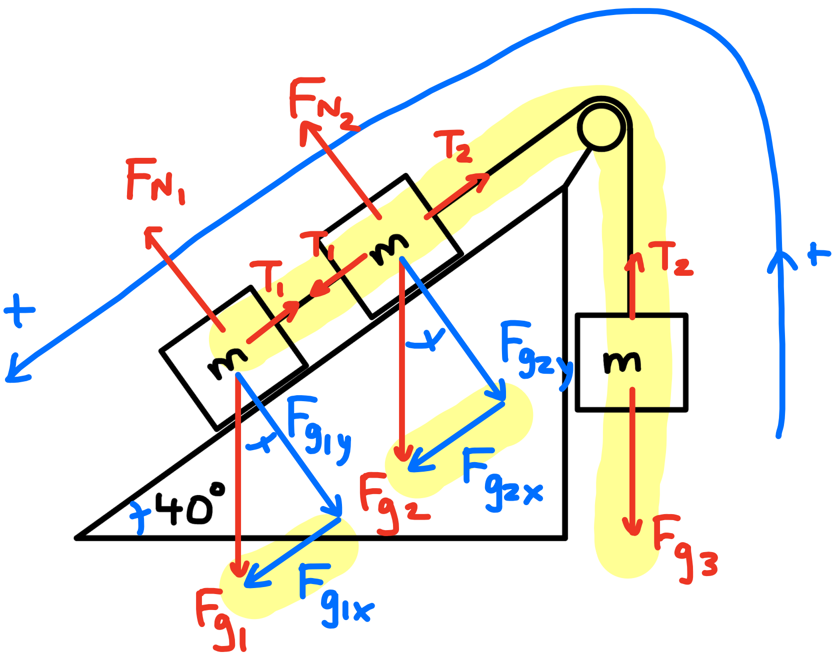
$$T = m_2 a + m_2 g$$

$$= (8)(2.92) + (8)(9.8)$$

$$= \boxed{102 \ N}$$

Determine the acceleration of the system if...

a) the slope is frictionless



$F_{g_{1x}} = F_{g_{2x}} = mg\sin 40^\circ$

$F_{g_{1y}} = F_{g_{2y}} = mg\cos 40^\circ$

$$F_{NET} = Ma$$

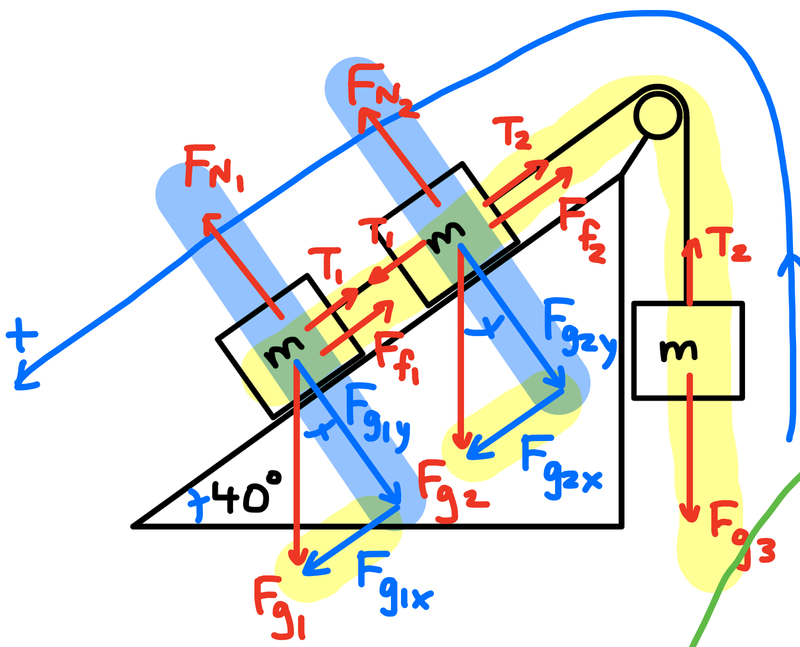
$$F_{g_{1x}} - \cancel{T_1} + \cancel{T_1} + F_{g_{2x}} - \cancel{T_2} + \cancel{T_2} - F_{g_3} = 3ma$$

$$\cancel{m}g\sin 40^\circ + \cancel{m}g\sin 40^\circ - \cancel{m}g = 3\cancel{m}a$$

$$a = \frac{g\sin 40^\circ + g\sin 40^\circ - g}{3}$$

$$= \boxed{0.933\ \frac{m}{s^2}\ \text{LEFT}}$$

b) the coefficient of friction is 0.1



$F_{g_{1x}} = F_{g_{2x}} = mg\sin 40°$
$F_{g_{1y}} = F_{g_{2y}} = mg\cos 40°$

$F_{N_1} = F_{g_{1y}} = mg\cos 40°$
$F_{N_2} = F_{g_{2y}} = mg\cos 40°$

$F_{NET} = Ma$

$$F_{g_{1x}} - F_{f_1} - \cancel{T_1} + \cancel{T_1} + F_{g_{2x}} - F_{f_2} - \cancel{T_2} + \cancel{T_2} - F_{g_3} = 3ma$$

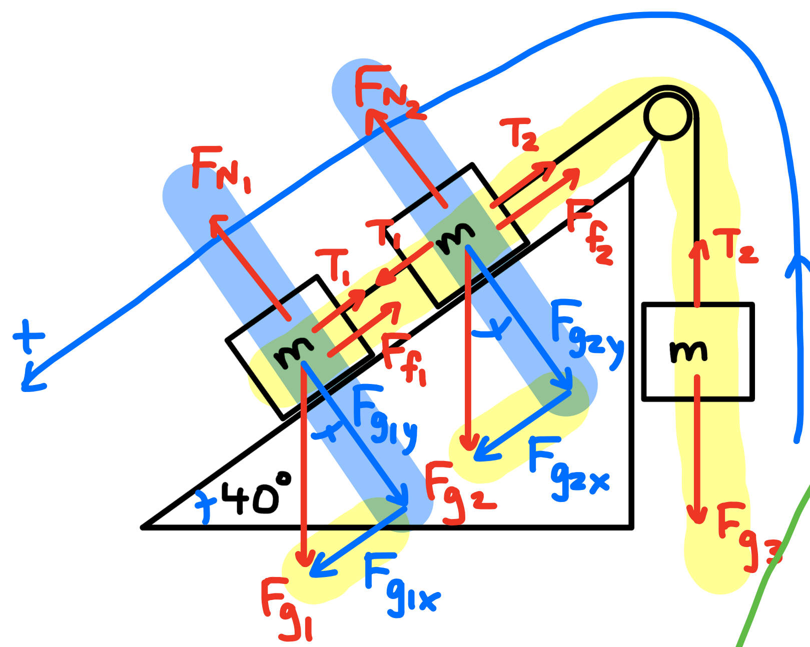
$$mg\sin 40° - \mu F_{N_1} + mg\sin 40° - \mu F_{N_2} - mg = 3ma$$

$$\cancel{m}g\sin 40° - \mu \cancel{m}g\cos 40° + \cancel{m}g\sin 40° - \mu\cancel{m}g\cos 40° - \cancel{m}g = 3\cancel{m}a$$

$$a = \frac{(2\sin 40° - 2\mu\cos 40° - 1)}{3} g$$

$$= \boxed{0.432 \ \frac{m}{s^2} \quad \text{LEFT}}$$

c) the coefficient of friction is 0.3



$F_{g1x} = F_{g2x} = mg\sin 40°$

$F_{g1y} = F_{g2y} = mg\cos 40°$

$F_{N_1} = F_{g1y} = mg\cos 40°$

$F_{N_2} = F_{g2y} = mg\cos 40°$

$F_{NET} = Ma$

$F_{g1x} - F_{f_1} - \cancel{T_1} + \cancel{T_1} + F_{g2x} - F_{f_2} - \cancel{T_2} + \cancel{T_2} - F_{g_3} = 3ma$

$mg\sin 40° - \mu F_{N_1} + mg\sin 40° - \mu F_{N_2} - mg = 3ma$

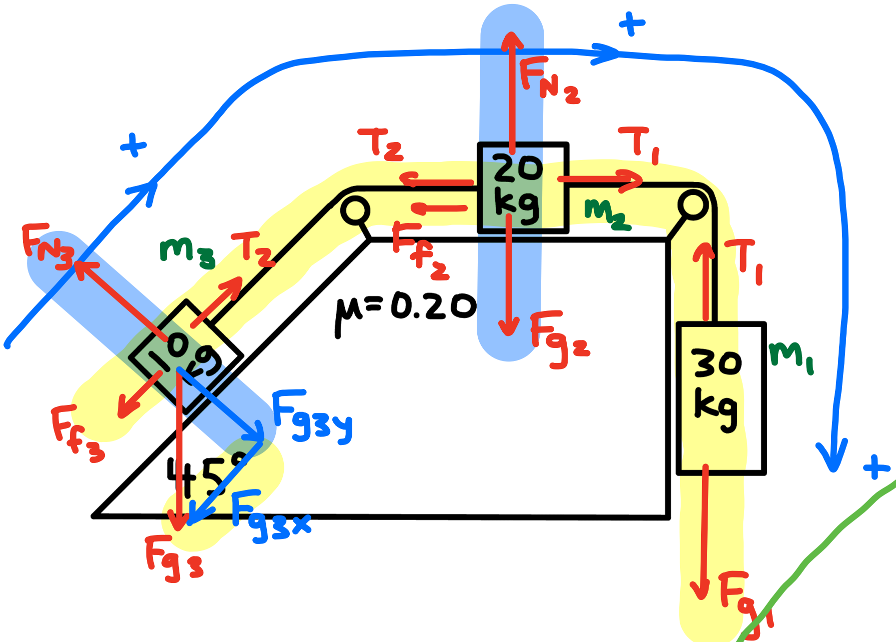
$\cancel{m}g\sin 40° - \mu\cancel{m}g\cos 40° + \cancel{m}g\sin 40° - \mu\cancel{m}g\cos 40° - \cancel{m}g = 3\cancel{m}a$

$$a = \frac{(2\sin 40° - 2\mu\cos 40° - 1)}{3}g$$

$= -0.569 \frac{m}{s^2}$

$\longrightarrow \boxed{0 \ \frac{m}{s^2}}$

Determine the acceleration of the system and the tension in each rope.



$$F_{g3x} = m_3 g \sin 45^\circ$$

$$F_{g3y} = m_3 g \cos 45^\circ$$

$$F_{N2} = F_{g2} = m_2 g$$

$$F_{N3} = F_{g3y} = m_3 g \cos 45^\circ$$

$$F_{NET} = Ma$$

$$F_{g1} - \cancel{T_1} + \cancel{T_1} - F_{f2} - \cancel{T_2} + \cancel{T_2} - F_{g3x} - F_{f3} = Ma$$

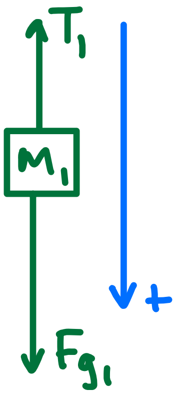
$$m_1 g - \mu F_{N2} - m_3 g \sin 45^\circ - \mu F_{N3} = Ma$$

$$m_1 g - \mu m_2 g - m_3 g \sin 45^\circ - \mu m_3 g \cos 45^\circ = Ma$$

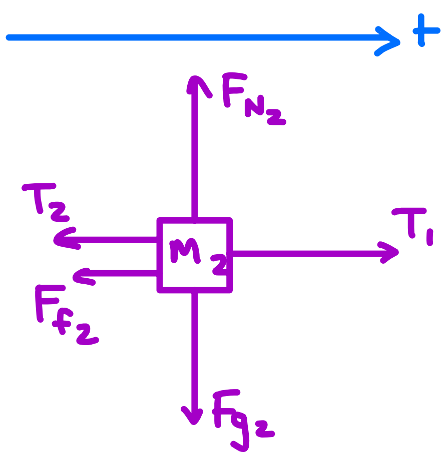
$$a = \frac{m_1 g - \mu m_2 g - m_3 g \sin 45^\circ - \mu m_3 g \cos 45^\circ}{M}$$

$$= \frac{(30)(9.8) - (0.20)(20)(9.8) - (10)(9.8)\sin 45^\circ - (0.20)(10)(9.8)\cos 45^\circ}{60}$$

$$= \boxed{2.86 \ \frac{m}{s^2} \ \text{RIGHT}}$$



$$F_{NET} = m_1 a$$
$$F_{g_1} - T_1 = m_1 a$$
$$m_1 g - T_1 = m_1 a$$
$$T_1 = m_1 g - m_1 a$$
$$= (30)(9.8) - (30)(2.86)$$
$$= \boxed{208\ N}$$



$$F_{NET} = m_2 a$$
$$T_1 - T_2 - F_{f_2} = m_2 a$$
$$T_1 - T_2 - \mu F_{N_2} = m_2 a$$
$$T_1 - T_2 - \mu m_2 g = m_2 a$$
$$T_2 = T_1 - \mu m_2 g - m_2 a$$
$$= 208 - (0.2)(20)(9.8) - (20)(2.86)$$
$$= \boxed{112\ N}$$