Question 1:

$m_1 = \vec{F} = 4.3 m/s^2$ $\quad m_1 = \frac{F}{a_1}$

$m_2 = 1.6 m/s^2$ $\quad m_2 = \frac{F}{a_2}$

$F = m_1 a_1 = m_2 a_2$

$a_1 = 4.3 m/s^2$ $\quad a = \frac{F}{m_1 + m_2}$

$a_2 = 1.6 m/s^2$

$a = \frac{F}{\frac{F}{a_1} + \frac{F}{a_2}}$

$a = \frac{1}{F\left(\frac{1}{a_1} + \frac{1}{a_2}\right)}$

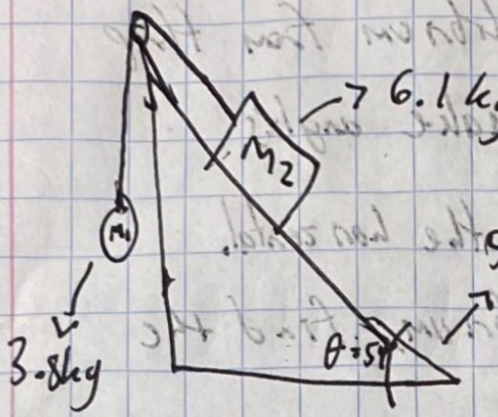
$a = \frac{1}{\frac{1}{4.3 m/s^2} + \frac{1}{1.6 m/s^2}}$

$a = \frac{1}{0.857}$

$\boxed{a = 1.166 m/s^2}$

$a = 5.9 m/s^2$

Question 2:



$M_1 g - T = M_1 a$

$a = \frac{M_1 g - M_2 g \sin(\theta)}{M_1 + M_2}$

$M_1 = 3.8\,kg$

$M_2 = 6.1\,kg$

$g = 9.81\,m/s^2$

$T = M_1 g - M_1 a$

$M_1 g - T = M_1 a$

$T - M_2 g \sin(\theta) = M_2 a$

$M_1 g - M_2 g \sin(\theta) = (M_1 + M_2) a$

$T = M_1 g - M_1 a$

$a = \frac{(3.8\,kg \cdot 9.81\,m/s^2) - (6.1\,kg \cdot 9.81\,m/s^2 \cdot 0.809)}{3.8\,kg + 6.1\,kg}$

$T = 3.8 \cdot 9.8 - 3.8 \cdot (-1.12)$

$a = \frac{37.24 - 48.35}{9.9}$

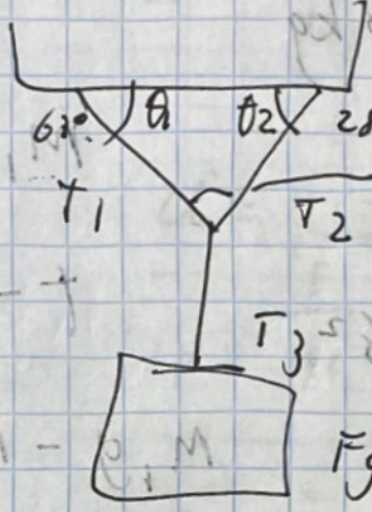
$T = 37.24 + 4.26$

$a = \frac{-11.11}{9.9}$

$\boxed{T = 41.5\,N}$

$\boxed{a = -1.12\,m/s^2}$

Question 3: A bag of cement of mass $M = 31.7\,kg$ hangs in equilibrium from three wires. Two of the wires make angles $\theta_1 = 63°$ and $\theta_2 = 28°$ with the horizontal. Assuming the system is in equilibrium, find the tension T_1 in the wire.



$M = 31.7\,kg$

$\theta_1 = 63°$

$\theta_2 = 28°$

$T_1 =$

$T_{1x} = T_1 \cos\theta$

$T_{1y} = T_1 \sin\theta$

$T_{2x} = T_2 \cos\theta_2$

$T_{2y} = T_2 \sin\theta_2$

$W = mg$

$T_1 \cos\theta_1 = T_2 \cos\theta_2$

$T_1 \sin\theta_1 + T_2 \sin\theta_2 = Mg$

$T_2 = \dfrac{T_1 \cos\theta_1}{\cos\theta_2}$

$T_1\left(\sin\theta_1 + \dfrac{T_1 \cos\theta_1}{\cos\theta_2}\right) = Mg$

$T_1 = \dfrac{Mg}{\left(\sin 63° + \dfrac{\cos 63° \sin 28°}{\cos 28°}\right)}$ $\quad (31.7\,kg)(9.8\,m/s^2)$

$\boxed{T_1 = 274.62\,N}$

Problem 4:

$$V_i = 97 km/h \left(\frac{1000 m}{3600 s}\right)$$

$$\boxed{V_i = 26.94 m/s}$$

$$V_f^2 = V_i^2 + 2ad$$

$$a = \frac{-V_i^2}{2d}$$

$$a = \frac{-(26.94)^2}{2 \cdot 37.5 m} = \frac{-725.44}{75} = -9.68 m/s^2$$

$$\boxed{a = -9.68 m/s^2}$$

$$a_n = a + g \sin\theta$$

$$\theta = 28 \cdot \left(\frac{\pi}{180}\right) = 0.488 rad$$

$$a_n = (-9.68 m/s^2) + (9.81 \cdot \sin(0.488))$$

$$g \sin\theta = (9.81 \cdot \sin(0.488))$$

$$a_n = (-9.68 m/s^2) + 4.594$$

$$9.81 \cdot (0.468 rad)$$

$$g \sin\theta = 4.594$$

$$\boxed{a_n = -5.080 m/s^2}$$