Single Body Analysis #5

Var	Given value	Units	Description
g	10	$\frac{m}{s^2}$	Acceleration due to gravity
m_1	88	kg	Mass 1
m_2	36	kg	Mass 2
m_3	10	kg	Masss 3
m_4	95	kg	Mass 4
m_5	112	kg	Mass 5
m_6	82	kg	Mass 6
m_7	110	kg	Mass 7
a		$\frac{m}{s^2}$	Acceleration
T_1		N	Tension 1
T_2		N	Tension 2
T_3		N	Tension 3
T_4		N	Tension 4
T_5		N	Tension 5
T_6		N	Tension 6

$$T_1 - m_1 g = m_1 a$$

$$T_2 - T_1 - m_2 g = m_2 a$$

$$T_3 - T_2 = m_3 a$$

Single Body Analysis #5 (continued)

$$T_4 - T_3 = m_4 a$$

$$T_5 + m_5 g - T_4 = m_5 a$$

$$T_6 + m_6 g - T_5 = m_6 a$$

$$m_7 g - T_6 = m_7 a$$

$$m_7 g + m_6 g + m_5 g - m_2 g - m_1 g = m_1 a + m_2 a + m_3 a + m_4 a + m_5 a + m_6 a + m_7 a$$

$$m_7 g + m_6 g + m_5 g - m_2 g - m_1 g = (m_1 + m_2 + m_3 + m_4 + m_5 + m_6 + m_7) a$$

$$\frac{m_7 g + m_6 g + m_5 g - m_2 g - m_1 g}{m_1 + m_2 + m_3 + m_4 + m_5 + m_6 + m_7} = a$$

$$a = \frac{m_7 g + m_6 g + m_5 g - m_2 g - m_1 g}{m_1 + m_2 + m_3 + m_4 + m_5 + m_6 + m_7}$$

$$= \frac{(110\text{kg})\left(10 \frac{\text{m}}{\text{s}^2}\right) + (82\text{kg})\left(10 \frac{\text{m}}{\text{s}^2}\right) + (112\text{kg})\left(10 \frac{\text{m}}{\text{s}^2}\right) - (36\text{kg})\left(10 \frac{\text{m}}{\text{s}^2}\right) - (88\text{kg})\left(10 \frac{\text{m}}{\text{s}^2}\right)}{(88\text{kg}) + (36\text{kg}) + (10\text{kg}) + (95\text{kg}) + (112\text{kg}) + (82\text{kg}) + (110\text{kg})}$$

$$= \boxed{3.377110694 \frac{\text{m}}{\text{s}^2}}$$ ✓

Single Body Analysis #5 (continued)

$$T_1 - m_1 g = m_1 a$$

$$T_1 = m_1 a + m_1 g$$

$$= (88\,\text{kg})\left(3.377110694\,\frac{\text{m}}{\text{s}^2}\right) + (88\,\text{kg})\left(10\,\frac{\text{m}}{\text{s}^2}\right)$$

$$= \boxed{1177.185741\,\text{N}} \quad \checkmark$$

$$T_2 - T_1 - m_2 g = m_2 a$$

$$T_2 - m_2 g = m_2 a + T_1$$

$$T_2 = m_2 a + T_1 + m_2 g$$

$$= (36\,\text{kg})\left(3.377110694\,\frac{\text{m}}{\text{s}^2}\right) + (1177.185741\,\text{N}) + (36\,\text{kg})\left(10\,\frac{\text{m}}{\text{s}^2}\right)$$

$$= \boxed{1658.761726\,\text{N}} \quad \checkmark$$

Single Body Analysis #5 (continued)

$$T_3 - T_2 = m_3 a$$

$$T_3 = m_3 a + T_2$$

$$= (10\,\text{kg})\left(3.377110694\,\frac{\text{m}}{\text{s}^2}\right) + (1658.761726\,\text{N})$$

$$= \boxed{1692.532833\,\text{N}}$$ ✓

$$T_4 - T_3 = m_4 a$$

$$T_4 = m_4 a + T_3$$

$$= (95\,\text{kg})\left(3.377110694\,\frac{\text{m}}{\text{s}^2}\right) + (1692.532833\,\text{N})$$

$$= \boxed{2013.358349\,\text{N}}$$ ✓

Single Body Analysis #5 (continued)

$$T_5 + m_5 g - T_4 = m_5 a$$

$$T_5 - T_4 = m_5 a - m_5 g$$

$$T_5 = m_5 a - m_5 g + T_4$$

$$= (112\,\text{kg})\left(3.377110694\ \frac{\text{m}}{\text{s}^2}\right) - (112\,\text{kg})\left(10\ \frac{\text{m}}{\text{s}^2}\right) + (2013.358349\ \text{N})$$

$$= \boxed{1271.594747\,\text{N}}$$ ✓

$$T_6 + m_6 g - T_5 = m_6 a$$

$$T_6 - T_5 = m_6 a - m_6 g$$

$$T_6 = m_6 a - m_6 g + T_5$$

$$= (82\,\text{kg})\left(3.377110694\ \frac{\text{m}}{\text{s}^2}\right) - (82\,\text{kg})\left(10\ \frac{\text{m}}{\text{s}^2}\right) + (1271.594747\ \text{N})$$

$$= \boxed{728.517824\,\text{N}}$$ ✓