Physics Dynamics + Motion

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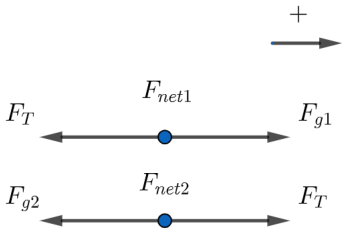
- All Forces of Tension (F_T) are equal. Example: $F_{T_1} = F_{T_2} = F_{T_3}$

8 Pulleys

8.1 Pulleys Example Problem 1

An atwood machine consists of masses of 3.8 kg and 4.2 kg. What is the acceleration (a) of the masses? What is the tension (F_T) in the rope?

8.1.1 Diagram and Givens



- $m_1 = 3.8$ kg
- $m_2 = 4.2$ kg
- $g = 9.8$ m/s^2
- $a = ?$
- $F_T = ?$

8.1.2 Finding equation for F_T

$$\therefore \quad F_{net_2} = F_T - F_{g_2}$$

$$\hookrightarrow \quad m_2 a = F_T - m_2 g \quad \rightarrow \quad m_2 a + m_2 g = F_T$$

$$\therefore \quad F_T = m_2 a + m_2 g$$

8.1.3 Finding equation for a

$$\therefore \quad F_{net_1} = F_{g_1} - F_T$$

$$\hookrightarrow \quad m_1 a = m_1 g - F_T \quad \rightarrow \quad m_1 a = m_1 g - (m_2 a + m_2 g)$$

$$\hookrightarrow \quad m_1 a = m_1 g - m_2 a - m_2 g \quad \rightarrow \quad m_1 a + m_2 a = m_1 g - m_2 g$$

$$\hookrightarrow \quad a(m_1 + m_2) = g(m_1 - m_2)$$

$$\therefore \quad a = \left(\frac{g(m_1 - m_2)}{(m_1 + m_2)} \right)$$

8.1.4 Solving for a

$$\therefore \quad a = \left(\frac{9.81(4.2 - 3.8)}{(4.2 + 3.8)} \right) \approx 0.49 \text{ m/s}^2$$

8.1.5 Solving for F_T

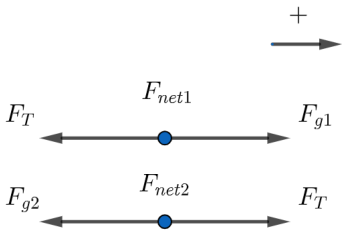
$$\therefore \quad F_T = m_2 a + m_2 g$$

$$= 3.8(0.49) + 3.8(9.81) \approx 39 \text{ N}$$

8.2 Pulleys Example Problem 2

The smaller mass on an Atwood machine is 5.2kg. If the masses accelerate at 4.6 m/s^2, what is the mass of the larger object? What is the tension in the rope?

8.2.1 Diagram and Givens



- $m_2 = 5.2$ kg
- $m_1 = ?$
- $g = 9.8$ m/s^2
- $a = 4.6$ m/s^2
- $F_T = ?$

8.2.2 Solving for m_1

9 Projectile Motion 1

10 Projectile Motion 2

11 Newton's Laws

12 Labs

13 Theory