Newton’s 2nd Law

- The connection between motion and forces

\[ \sum F = ma \]

Forces FBDs
Motion MDs

Practice Problem

- Physics Principles
- Circle the Object
- Draw Coordinate
- Identify Forces, On & By
- Make Component Table
- Write Newton’s Law in Component Form
- List other information
- Solve
- Evaluate

A 7.0-kg bucket of tools is raised from the ground by a rope. If the upward acceleration of the bucket is 4.0 m/s², find the force exerted by the rope on the bucket.

Practice Problem

- Physics Principles
- Circle the Object
- Draw Coordinate
- Identify Forces, On & By
- Make Component Table
- Write Newton’s Law in Component Form
- List other information
- Solve
- Evaluate

A 50.0-kg wagon is towed up a hill inclined at 20° with above the horizontal. The tow rope is parallel to the incline and has a tension of 150 N. Assume that the wagon starts from rest at the bottom of the hill, and neglect friction. How fast is the wagon going after moving 60.0 m up the hill?

Practice Problem

- Physics Principles
- Circle the Object
- Draw Coordinate
- Identify Forces, On & By
- Make Component Table
- Write Newton’s Law in Component Form
- List other information
- Solve
- Evaluate

Two boxes of fruit on a horizontal surface are connected by a string, where \( m_1 = 10 \) kg and \( m_2 = 20 \) kg. A force of 50 N is applied to the 20-kg box. Determine the acceleration of each box & the tension in the string. The coefficient of kinetic friction is 0.10.

Answers

- 1. \( T = 96.6 \) N up
- 2. \( T = 694 \) N in direction opposite the velocity.
- 3. Newton’s 2nd Law equation:

   \[ \sum F = ma \]

   When \( W = 167.6 \) what is \( a \) and how does that value match with the problem statement. Can you find what is wrong?

   \[ \sum F = ma \]
   \[ T - W_1 = 50 \text{ kg}(a) \]
   \[ 150N - W_2 = 50 \text{ kg}(a) \]

   \[ 4. \ T = 16.7 \text{ N right and } a = 0.69 \text{ m/s}^2 \text{ right} \]