

Learning Target S8P3.b I can construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.

Learning Target S8P3.c Construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).

Newton's 2nd Law of Motion Balanced vs. Unbalanced Forces Interactive Activity



Part 1: Newton's Second Law of Motion

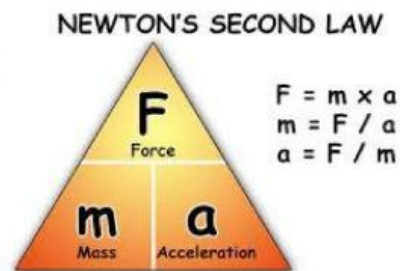
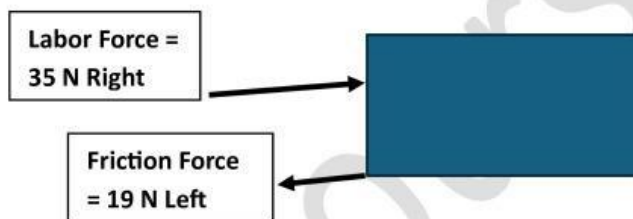
Newton's Second Law of Motion states: *The acceleration of an object is _____ proportional to the net force acting on it and _____ proportional to its mass.* This relationship can be expressed mathematically as: Force (F) = Mass (M) x Acceleration (A)

Where:

- **F** = Force (in Newtons, N)
- **m** = Mass (in kilograms, kg)
- **a** = Acceleration (in meters per second squared, m/s²)

Diagram 1: Forces on a Block

Study the diagram below and answer the questions that follow.



Questions:

1. Calculate the net force acting on the block. _____
2. If the mass of the block is 4 kg, determine its acceleration. _____
3. Explain how the net force and acceleration are related in this example. _____

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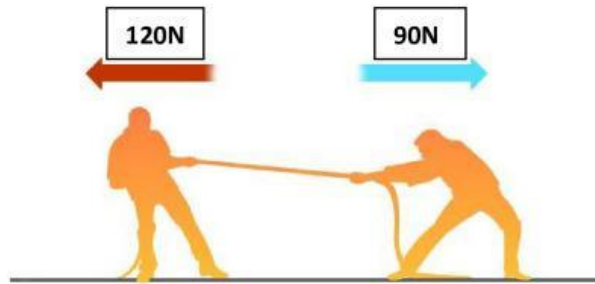
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Part 2: Balanced and Unbalanced Forces

Definition:

- **Balanced Forces:** Forces that are _____ in size and _____ in direction, resulting in no change in _____.
- **Unbalanced Forces:** Forces that are not _____, causing a change in _____ (acceleration).

Diagram 2: Tug of War

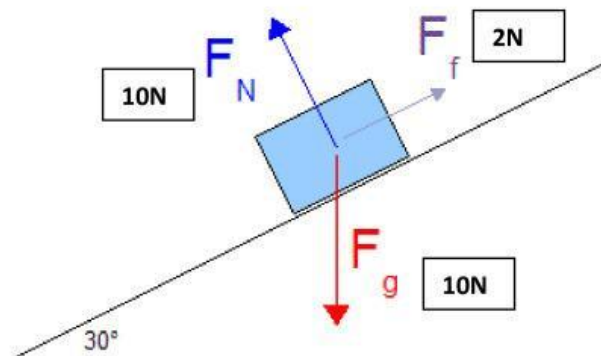


Questions:

1. Are the forces balanced or unbalanced in this scenario? _____
Explain your reasoning. _____

2. Predict the motion of the rope and justify your answer. _____

Diagram 3: Box on a Ramp



Questions:

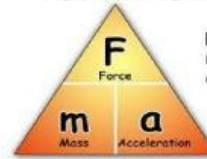
1. Is the box in motion? _____ Why or why not? _____

2. Identify which forces are balanced and which are unbalanced. _____

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NEWTON'S SECOND LAW



$$F = m \times a$$

$$m = F / a$$

$$a = F / m$$

Part 3: Graphing Force, Mass, and Acceleration

The relationship can be represented graphically:

1. Graph 1: Acceleration vs. Force:

Tasks:

1. Complete the table by calculating acceleration.
2. Plot the data points and draw the graph. (If time permits)
3. Describe the trend shown by the graph. (If time permits)

Force (N)	Mass (kg)	Acceleration (m/s ²)
10	2	
20		10
	2	15
40	2	

Graph 2: Acceleration vs. Mass

Tasks:

- Complete the table by calculating acceleration.
- Plot the data points and draw the graph. (If time permits)
- Describe how mass affects acceleration when force is constant. _____

Force (N)	Mass (kg)	Acceleration (m/s ²)
	1	20
20		10
20	3	
40	2	

Challenge Problem: A 10 kg cart is being pulled by a force of 50 N. Friction opposes the motion with a force of 10 N.

1. Calculate the net force acting on the cart. _____
2. Determine the cart's acceleration. _____
3. If the force is doubled, predict how the acceleration would change and explain your reasoning. _____

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Reflection Questions:

1. How does Newton's Second Law help us understand everyday movements? _____

2. Why is it important to distinguish between balanced and unbalanced forces? _____

