

Warm-Up

Introduction to Forces

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Lesson Question

How do forces affect the motion of an object?

Lesson Goals

Describe the concept of

force

Explain how to determine the net force on an

object

Distinguish

between balanced and unbalanced forces and their effects on

motion

W
2K

Words to Know

Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.

 B magnitude C force A friction F gravity D normal force E vector

A. a resistance to motion caused by two surfaces rubbing against each other

B. the size or quantity of something

C. a push or pull

D. the support force a surface exerts on an object; always at a ninety-degree angle to the surface a push or pull

E. a quantity that has both a size and a direction

F. the force that one massive object exerts to attract another object to it; expressed as the weight of an object

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**Motion**

- Motion is recognized when an object's **position** from a reference point changes.
- Motion can be described by:
 - a **speed**.
 - a **velocity**.
 - an **acceleration**.

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Forces

- A **force** is a push or a **pull**.
- Forces are **vectors**.
 - A vector has both a magnitude and a **direction**.
 - **Magnitude** is the size or quantity of something.
 - A vector is indicated with an **arrow**.
 - A vector can have a positive or **negative** value.
- Forces are measured in **newtons** (N).

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Force Diagrams and Abbreviations

- A force diagram is a drawing with force **vectors** whose sizes and directions represent the magnitudes and directions of the forces acting on an object. Abbreviations are used to identify which type of force each vector represents.
 - The **length** of a force vector represents the magnitude, or size, of the force.
 - The **direction** of the force vector shows which direction the force is acting in and abbreviations to tell you what type of force each vector represents.

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Force Diagrams and Abbreviations

- Some common forces are:

- Push or pull,

 F_p

- Normal** force, F_N : always at

a **90**

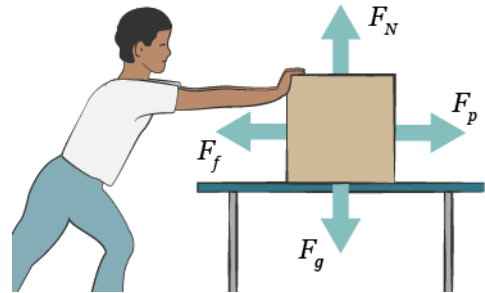
-degree right angle

- Friction,

 F_f

: slows object down

- Gravity**

, F_g : weight

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Words to Know

counteract	to act against something, causing it to have less of an effect
net force	the sum of all of the forces acting on an object

Multiple Forces

- Forces that act in the same direction **combine**.
- Forces that act in opposite directions **counteract** each other.

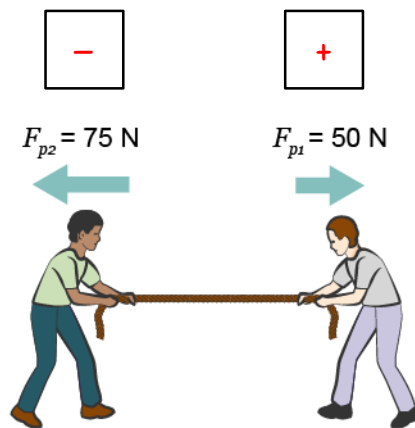
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Net Force

- The net force is the sum of all of the **forces** that act on an object.
- Positive and negatives have to be assigned for **direction** before adding forces together.
- When assigning positives and negatives to forces, forces pointing to the **right** are positive, and forces pointing to the **left** are negative.

Label the forces shown as positive (+) or negative (–).



- The net force in the illustration is **-25 N** .

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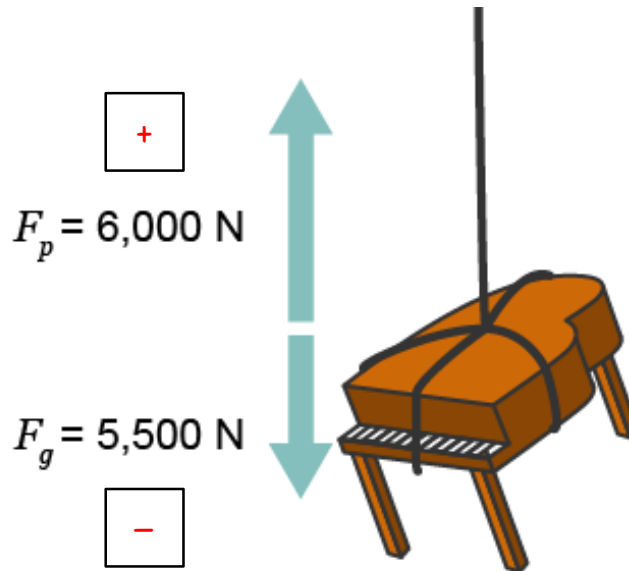
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Parallel Forces

- Only **parallel** forces can be added together.
- Left and **right** can be added together.
- Up and **down** can be added together.

Label the forces shown as positive (+) or negative (-).



- The sum of the forces acting on this piano is **500 N**.

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Balanced Forces

- When forces acting in **opposite** directions are exactly equal:
 - The net force is **zero**.
 - There is no change in **motion**.
 - It's important to know that a zero net force does **not** mean there is no motion. It simply means that there is no change from what is already happening.

Unbalanced Forces

- When forces acting in opposite directions are **unequal** :
 - The net force is positive or negative in the direction of the **greater** force.
 - There is a change in **motion**.
 - **Speed**
 - **Direction**
 - Both speed and direction
 - The motion of the object is in the same **direction** as the net force.
- Unbalanced forces can start an object moving or stop an object from moving.

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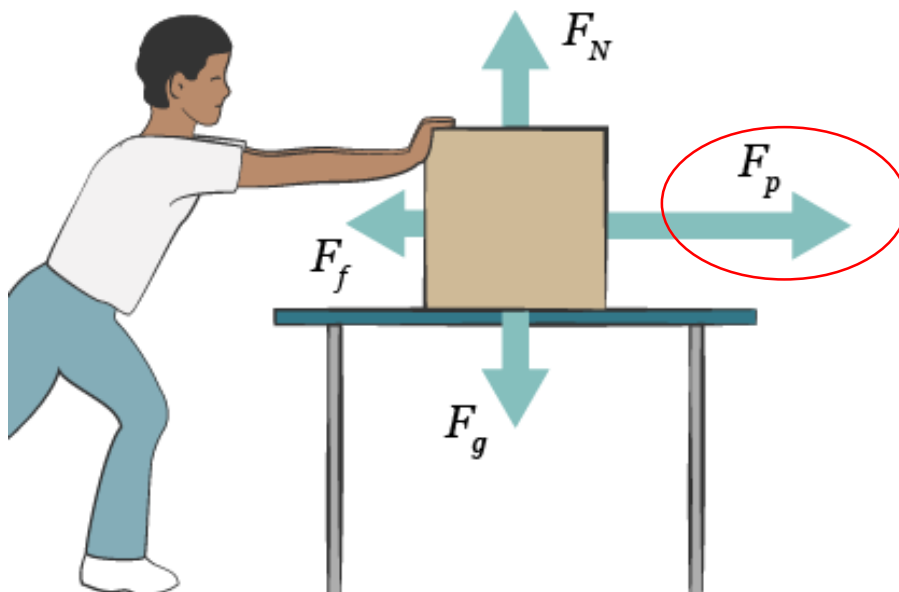
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Force Diagrams and Unbalanced Forces

- Force diagrams show when forces are balanced or **unbalanced**.
- The length of the vector represents the **strength** of the force.
- The longer the vector is the **more** force there is.
- The net force and the motion will be in the direction of the **longest** vector.

Circle the vector that represents the largest force.



Summary

Introduction to Forces



Lesson Question

How do forces affect the motion of an object?



Answer

(Sample answer) Unbalanced forces acting on an object can change the object's speed, direction, or both. Balanced forces do not affect the motion of an object.

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Review: Key Concepts

FORCES

- A **force** is a push or a pull.
- Forces are **vectors** with magnitude and direction.
- Force diagrams show the type, magnitude, and **direction** of the forces acting on an object.
 - **Push** or pull, F_p
 - **Gravity**, F_g
 - **Normal**, F_N
 - **Friction**, F_f

Summary

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Review: Key Concepts

NET FORCE

- The **net** force is the sum of all forces acting on an object.
 - A net force of zero means that all forces are in **balance** and there is no change in motion.
 - A positive or negative net force causes a change in motion in the direction of the **greater** force.

Use this space to write any questions or thoughts about this lesson.