Forces and Newton’s Laws
Section 2 Newton’s Laws of Motion

Objectives Read the section objectives. Then write three questions that come to mind from reading these statements.

1. Accept all reasonable responses.
2. ____________________________
3. ____________________________

Define acceleration to show its scientific meaning.

The rate of change of velocity

Read the definitions below, then write the key term for each one in the left column.

- Newton’s third law of motion
- Inertia
- Newton’s first law of motion
- Newton’s second law of motion

states that when one object exerts a force on a second object, the second object exerts a force on the first that is equal in strength and opposite in direction

is the tendency of an object to resist any change in its motion

states that an object moving at a constant velocity keeps moving at that velocity unless an unbalanced force acts on it

“The acceleration of an object is in the same direction as the net force on the object, and the acceleration can be calculated from the equation \[ a = \frac{F_{\text{net}}}{m}. \]”

Use a dictionary to define the term period.

the completion of a cycle, a series of events, or a single action
Newton's First Law of Motion

Object in motion will move in a straight line at a constant speed unless acted on by an unbalanced force which can change the speed or the direction of the object.

Object at rest will stay at rest unless acted on by an unbalanced force which can make the object move.

Model a rock being thrown at a wall and a car crashing into the wall.

Inertia and Mass

Predict which object will do more damage, and support your answer by using the concept of inertia. Accept all reasonable diagrams.

The car has more mass and inertia than a rock. It takes more force to stop a car. So the wall will stand up to the inertia of the rock, but may crumble beneath the car.

Analyze the forces on a hockey puck sinking through water. Draw a force diagram for the puck in the water.

Gravity pulls the puck downward. The buoyant force of the water pushes the puck up. The forces are not balanced, therefore the hockey puck's velocity is changing.
Section 2 Newton’s Laws of Motion (continued)

**Main Idea**

**Newton’s Second Law of Motion**

I found this information on page ______.  
SE, p. 81  
RE, pp. 47–48

**Relating Force, Mass, and Acceleration**

I found this information on page ______.  
SE, p. 82  
RE, pp. 47–48

**Details**

**Summarize** Newton’s second law of motion *in your own words.*  
Accept all reasonable responses. The net force acting on an object causes the object to accelerate in the direction of the net force.

**Complete** the concept map with the 3 physical properties of an object that are related by Newton’s second law of motion.

![Concept Map](image)

**Organize** the 3 variables related by Newton’s second law in the table. Show equations to find each variable if you know the values of the other two variables.

<table>
<thead>
<tr>
<th>Newton’s Second Law of Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unknown Variable</strong></td>
</tr>
<tr>
<td>Acceleration</td>
</tr>
<tr>
<td>Net force</td>
</tr>
<tr>
<td>Mass</td>
</tr>
</tbody>
</table>
Main Idea

Newton’s Third Law of Motion

I found this information on page 84–85.

Details

Summarize Newton’s third law of motion in your own words.
Accept all reasonable responses. When one object applies a force on a second object, the second object applies a force on the first object that is equal in strength and opposite in direction.

Predict the corresponding reaction for each action.

<table>
<thead>
<tr>
<th>Action</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A high-jumper lands on a mat.</td>
<td>The mat pushes back and the jumper bounces.</td>
</tr>
<tr>
<td>A fisherman tosses an anchor away from his boat.</td>
<td>The anchor exerts a force on the fisherman and his boat, pushing him in the opposite direction.</td>
</tr>
<tr>
<td>An airplane’s jet engine pushes air toward the back of the airplane.</td>
<td>The air pushes back and the airplane moves forward.</td>
</tr>
</tbody>
</table>

Summarize It

Summarize the relationship between a moving object’s mass, its inertia, and the forces acting on it.

Accept all reasonable responses. The greater the object’s mass, the more inertia it has, and the larger the net force needed to change the object’s velocity. A moving object will tend to keep moving with the same velocity unless acted on by an unbalanced net force.