

# Forces and Newton's Laws

CHAPTER 3  
DRW

## Section 1 Forces

**Predict** Read the title of Section 1. List three things that might be discussed in this section.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

### Review Vocabulary

**Define** mass in a sentence to show its scientific meaning.

mass

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### New Vocabulary

Use your book or dictionary to define the following terms.

force

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net force

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friction

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gravity

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field

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weight

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### Academic Vocabulary

Use a dictionary to define survive.

range

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## Section 1 Forces (continued)

### Main Idea

#### What is force?

I found this information  
on page \_\_\_\_\_.

### Details

**Model** an apple hanging from a tree and a falling apple. Include arrows with labels to show all forces acting on the apples.

Hanging Apple

Falling Apple

**Analyze** the forces acting on the apple in each drawing and how they combine to form the net force.

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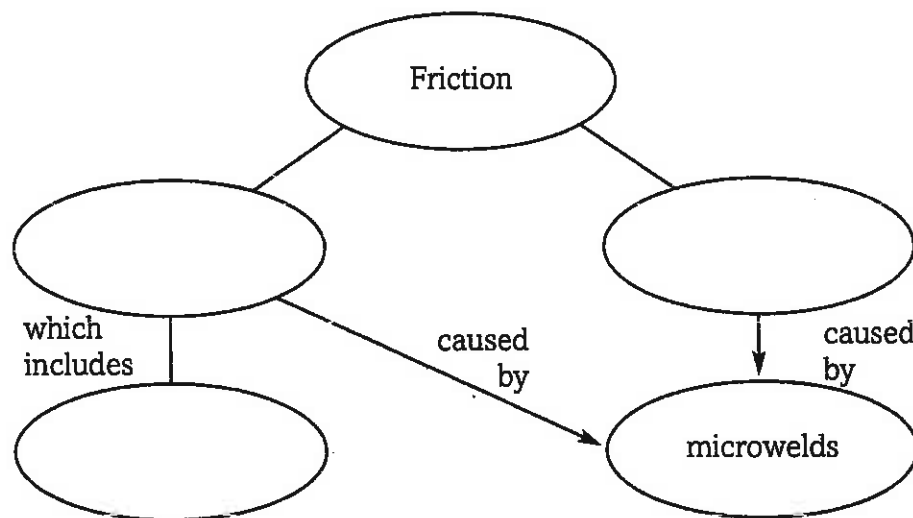


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### Friction

I found this information  
on page \_\_\_\_\_.

**Complete** the concept map, using the information in your book.



**Fill in** the blanks to complete the concept of friction.

The amount of friction between two \_\_\_\_\_ depends on the \_\_\_\_\_ of surfaces and the \_\_\_\_\_ pressing the surfaces together. Rougher surfaces have more bumps and can form \_\_\_\_\_, increasing the amount of friction.

Section 1 Forces (continued)

**Main Idea**

**Gravity**

*I found this information  
on page \_\_\_\_\_.*

**The Law of  
Universal  
Gravitation**

*I found this information  
on page \_\_\_\_\_.*

**Weight**

*I found this information  
on page \_\_\_\_\_.*

**Details**

**Predict** *why Earth's ocean tides are influenced more by the Moon than by the Sun, even though the Sun is much bigger than the Moon.*

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**Summarize** *the law of universal gravitation in a complete sentence.*

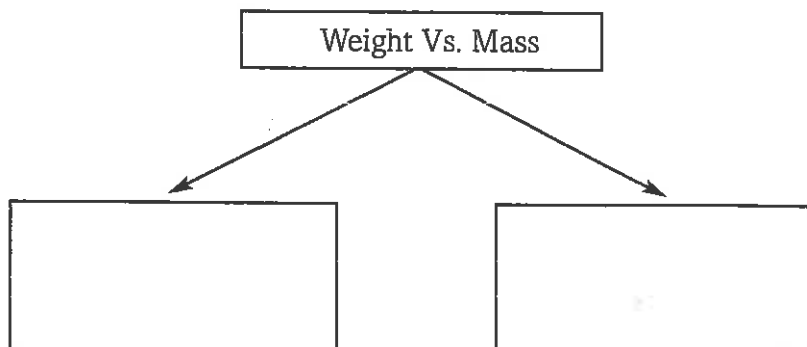
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**Write** the definitions of weight and mass in the boxes.



## Section 1 Forces (continued)

## Main Idea

### Weight

I found this information  
on page \_\_\_\_\_

### Weight Away from Earth

I found this information  
on page \_\_\_\_\_

## Details

**Analyze** the formula  $W = mg$  to explain how an object's weight can change even when its mass remains constant.

**Find** your weight on other planets. Multiply the gravity factor times your mass.  $W = mg$

Planetary Body	Your mass* (m)	Gravity factor (g)	Your weight in kg (w)
Sun		28	
Mercury		0.4	
Venus		0.9	
Earth		1.0	
Mars		0.4	
Jupiter		2.5	
Saturn		1.1	
Uranus		0.9	
Neptune		1.2	

\*To find your mass divide your weight in kg by 9.8.

## CONNECT IT

Explain how Neptune was discovered.

# 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. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

### Review Vocabulary

acceleration

Define acceleration to show its scientific meaning.

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### New Vocabulary

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

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  $a = F_{\text{net}}/m$ ."

### Academic Vocabulary

period

Use a dictionary to define the term period.

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## Section 2 Newton's Laws of Motion (continued)

### Main Idea

#### Newton's First Law of Motion

I found this information  
on page \_\_\_\_\_.

#### Inertia and Mass

I found this information  
on page \_\_\_\_\_.

### Details

**Summarize** *Newton's first law of motion by telling how an object in motion's inertia is changed and how an object at rest is affected.*

Object in motion \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Object at rest \_\_\_\_\_

\_\_\_\_\_

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

**Predict** *which object will do more damage, and support your answer by using the concept of inertia.*

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Section 2 Newton's Laws of Motion (continued)

### Main Idea

#### Newton's Second Law of Motion

I found this information  
on page \_\_\_\_\_.

#### Relating Force, Mass, and Acceleration

I found this information  
on page \_\_\_\_\_.

I found this information  
on page \_\_\_\_\_.

### Details

**Summarize** Newton's second law of motion *in your own words*.

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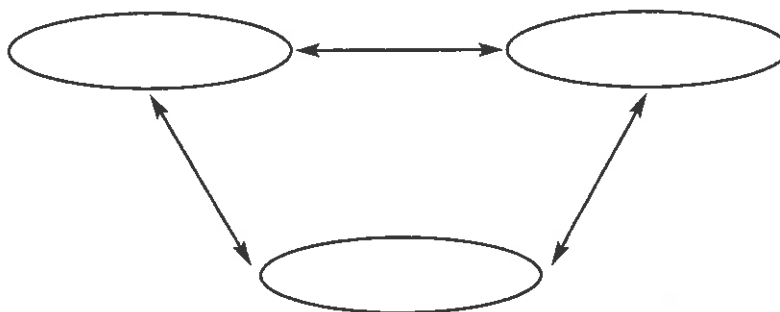


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**Complete** the concept map with the 3 physical properties of an object that are related by Newton's second law of motion.



**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.

Newton's Second Law of Motion		
Unknown Variable	Known Variables	Equations
Acceleration		
Net force		
Mass		

## Section 2 Newton's Laws of Motion (continued)

### Main Idea

#### Newton's Third Law of Motion

I found this information  
on page \_\_\_\_\_.

### Details

**Summarize** *Newton's third law of motion in your own words.*

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**Predict** *the corresponding reaction for each action.*

Action	Reaction
A high-jumper lands on a mat.	
A fisherman tosses an anchor away from his boat.	
An airplane's jet engine pushes air toward the back of the airplane.	

### SUMMARIZE IT

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

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# Forces and Newton's Laws

## Section 3 Using Newton's Laws

**Skim** through Section 3 of your book. Write three questions that come to mind from reading the headings and the illustration captions.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

### Review Vocabulary

**Define** momentum using a dictionary or your book.

momentum

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### New Vocabulary

**State** the definitions of the terms below as found in your book.

air resistance

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centripetal force

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law of conservation of momentum

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### Academic Vocabulary

**Use** a dictionary to define initial. Then use it as an adjective in a sentence to show its scientific meaning.

initial

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Section 3 Using Newton's LAWS (continued)

**Main Idea**

**What happens in a crash?**

*I found this information on page \_\_\_\_\_*

**Newton's Second Law and Gravitational Acceleration**

*I found this information on page \_\_\_\_\_*

**Air Resistance**

*I found this information on page \_\_\_\_\_*

**Details**

**Analyze** the effects on a passenger riding in a car traveling at 50 km/h that collides head-on with a solid object.

Without Restraints	With Safety Belts and Air Bags

**Analyze** the formula  $W = mg$  to explain how an object's weight can change even when its mass remains constant.

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**Contrast** the terminal velocity of a parachutist with an open chute to the terminal velocity of the same parachutist with a closed chute.

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Section 3 Using Newton's LAWS (continued)

**Main Idea**

**Weightlessness and Free Fall**

I found this information on page \_\_\_\_\_.

**Centripetal Forces**

I found this information on page \_\_\_\_\_.

**Force and Momentum**

I found this information on page \_\_\_\_\_.

**Details**

**Distinguish** between an object that is truly weightless and an object that is weightless because it is in free fall.

**Create** a top view of an object moving in a circle at constant speed, such as a ball on a string. Show at least two positions of the object. At each position, draw an arrow for the object's velocity and another arrow for the centripetal acceleration of the object.

**Calculate** the force that is needed to propel a rocket into space if the rocket weighs 10,000 kg and the escape velocity for Earth's gravity is 11 km/s. (Hint: use the formula  $F = ma$ ).

Fill in the information below before calculating.

Mass	
Initial velocity	
Final velocity	
Time	10 minutes
Force	

**SUMMARIZE IT**

After Reading this chapter, summarize Newton's three laws of motion.

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