

**Key Concept Builder** 

**LESSON 1**

## Gravity and Friction

**Key Concept** What are some contact forces and some noncontact forces?

**Directions:** *On the line before each motion, write C if it is caused by a contact force or N if it is caused by a noncontact force.*

- \_\_\_\_\_ 1. rain falling
- \_\_\_\_\_ 2. papers scattered by wind
- \_\_\_\_\_ 3. a baseball sailing into the outfield
- \_\_\_\_\_ 4. a magnet attracting a nail
- \_\_\_\_\_ 5. rocks tumbling down a mountain
- \_\_\_\_\_ 6. an elevator ascending
- \_\_\_\_\_ 7. an arrow flying toward a target
- \_\_\_\_\_ 8. lightning striking a building
- \_\_\_\_\_ 9. a brick wall collapsing
- \_\_\_\_\_ 10. a meteorite hitting Earth

**Directions:** *Answer each question on the lines provided.*

11. What is a force?

\_\_\_\_\_

12. What is a contact force?

\_\_\_\_\_

13. What is a noncontact force?

\_\_\_\_\_  
\_\_\_\_\_

14. What is the unit of force?

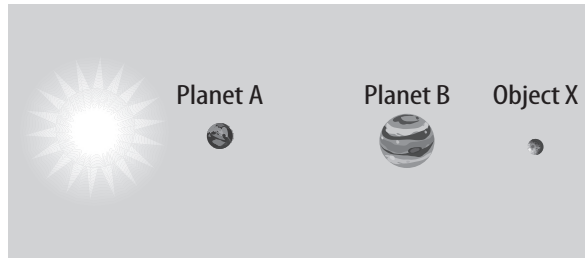
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**Key Concept Builder** 

**LESSON 1**

## Gravity and Friction

**Key Concept** What is the law of universal gravitation?



This diagram represents a star orbited by two planets—planet A and planet B. The star is also orbited by a mysterious object, object X, that entered into the star’s gravitational field.

**Directions:** Use the diagram to answer each question or respond to each statement.

1. The gravitational force between the star and planet A is the same as the gravitational force between the star and planet B. Explain why this is true.

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2. The gravitational force between the star and object X is equal to the forces between the star and the two planets. From that information, what can you conclude about object X?

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**Directions:** Answer each question on the lines provided.

3. What is gravity?

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4. What happens to the gravitational attraction between two objects as the distance between them increases?

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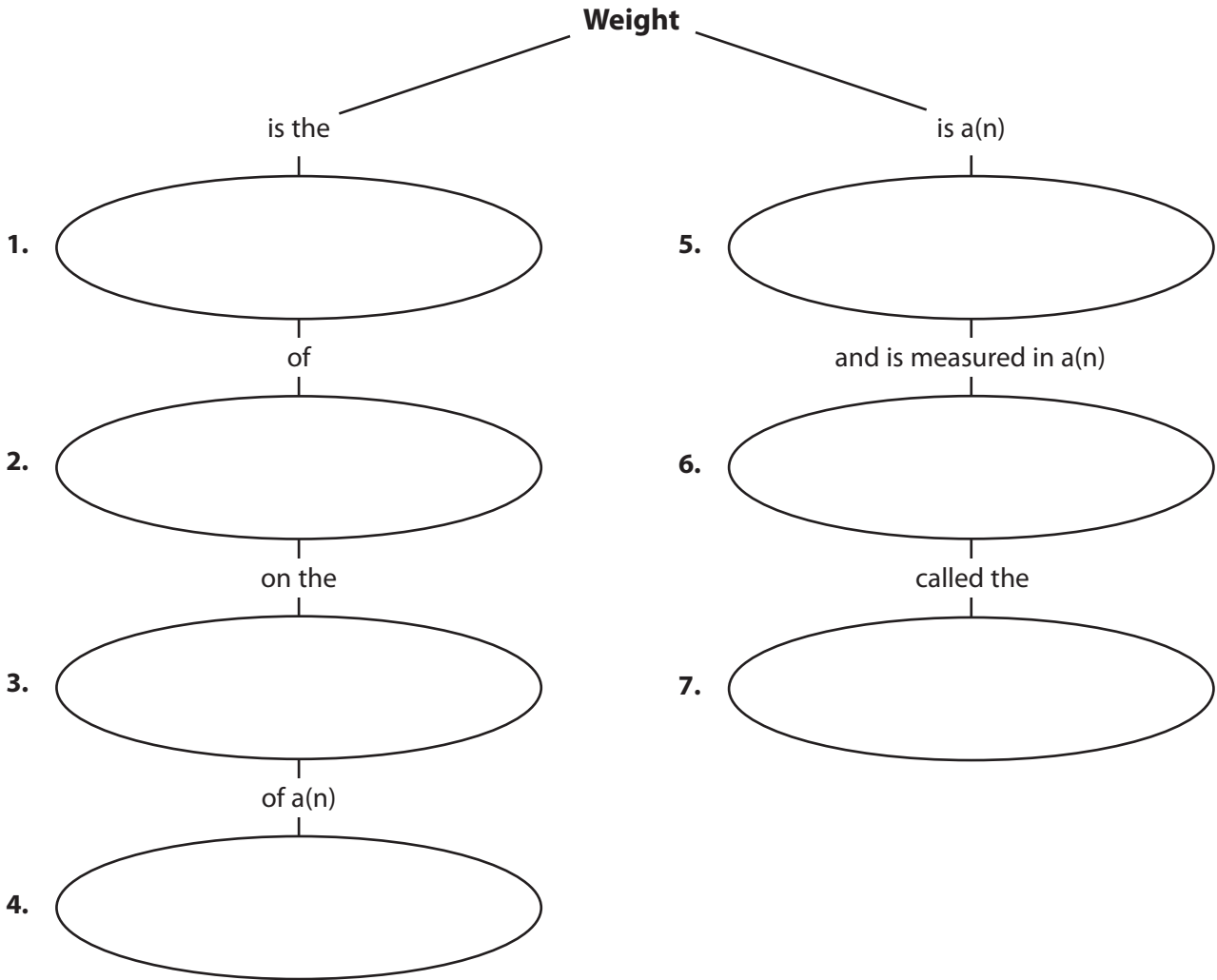
**LESSON 1**

**Gravity and Friction**

**Key Concept** What is the law of universal gravitation?

**Directions:** Complete this concept map by choosing terms from the word bank and writing them in the correct spaces.

effect      force      gravity      mass      newton      object      unit



**Directions:** On the line before each statement, write T if the statement is true or F if the statement is false.

- \_\_\_\_\_ 8. An object that has twice as much mass as another weighs four times as much.
- \_\_\_\_\_ 9. Near Earth's surface, the weight of an object in newtons is about 10 times its mass in kilograms.
- \_\_\_\_\_ 10. The weight of an astronaut in orbit is about 90 percent of the astronaut's weight on Earth.

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**Key Concept Builder** **LESSON 1****Gravity and Friction**

**Key Concept** How does friction affect the motion of two objects sliding past each other?

**Directions:** On each line, write the term from the word bank that correctly completes each sentence. Each term is used only once.

<b>electrical</b>	<b>fluid</b>	<b>lubricants</b>	<b>microscopic</b>
<b>movement</b>	<b>resistance</b>	<b>sliding</b>	<b>static</b>

1. Friction is a force that opposes \_\_\_\_\_.
2. To push a heavy crate across a floor, you must first overcome \_\_\_\_\_ friction, which tends to hold it in place.
3. After overcoming that form of friction, you must push against \_\_\_\_\_ friction.
4. Friction between a surface and air or a liquid is called \_\_\_\_\_ friction.
5. Air friction on a car or airplane is also called air \_\_\_\_\_.
6. Friction between solid surfaces is caused mostly by roughness on a(n) \_\_\_\_\_ scale.
7. Friction can also be caused by \_\_\_\_\_ attraction between particles.
8. Friction between solid surfaces can be reduced with \_\_\_\_\_.

**Key Concept Builder** **LESSON 2****Newton's First Law**

**Key Concept** What is Newton's first law of motion?

**Directions:** Work with a partner on the following thought experiments. Answer each question or respond to each statement on the lines provided.

- 1. Suppose** the universe were completely empty except for one object—a solid sphere moving through space at a speed of 100 km/s. What sort of path would the object be moving in? Explain your answer.

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- 2.** How long will it take for the object to come to a stop? Explain your answer.

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- 3. Imagine** another universe that is completely empty except for a large solid sphere at rest. Suddenly, an identical sphere pops into existence 1 trillion kilometers away. What will happen?

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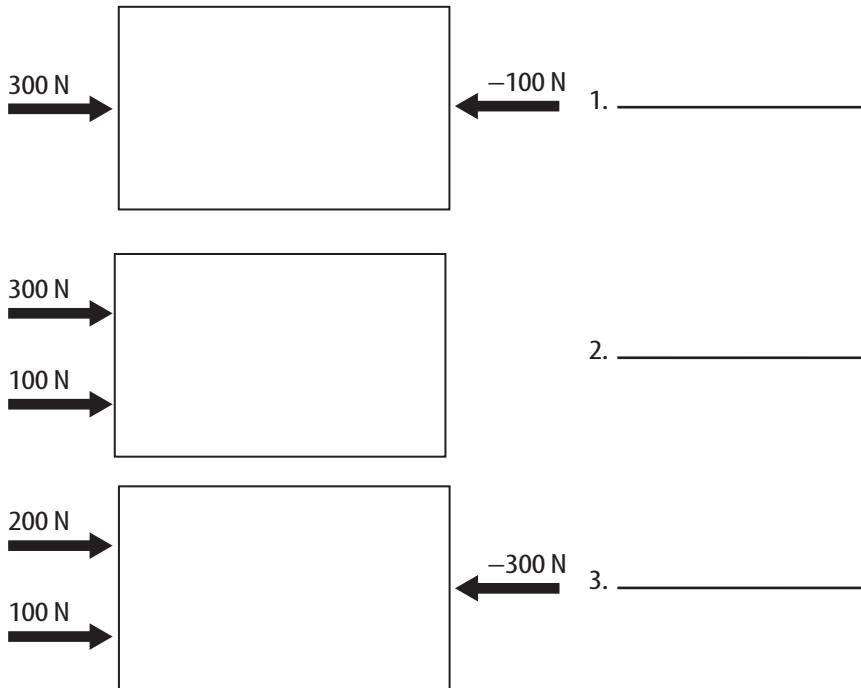
**Key Concept Builder** 

**LESSON 2**

**Newton's First Law**

**Key Concept** How is motion related to balanced and unbalanced forces?

**Directions:** The diagrams below represent sliding forces applied to a large box. Write the net force applied to each box on the line next to each diagram.



**Directions:** On each line, write the term that correctly completes the sentence.

4. Because forces have directions, you must specify a(n) \_\_\_\_\_ when you combine forces.
5. A force exerted in that direction is \_\_\_\_\_, and a force exerted in the opposite direction is \_\_\_\_\_.
6. The combination of forces acting on an object is the \_\_\_\_\_.

**Key Concept Builder** **LESSON 2****Newton's First Law****Key Concept** How is motion related to balanced and unbalanced forces?

Balanced forces produce a lack of motion or a steady velocity. Unbalanced forces put a stationary object into motion (produce an acceleration) or change the velocity of a moving object.

**Directions:** *On the line before each item, write B if it represents balanced forces or U if it represents unbalanced forces.*

- \_\_\_\_\_ 1. a book lying on a table
- \_\_\_\_\_ 2. an airplane cruising in level flight
- \_\_\_\_\_ 3. a rock falling from a cliff
- \_\_\_\_\_ 4. a bridge collapsing in an earthquake
- \_\_\_\_\_ 5. a train rounding a curve at a steady speed
- \_\_\_\_\_ 6. a man sitting on a park bench
- \_\_\_\_\_ 7. the space shuttle taking off
- \_\_\_\_\_ 8. a satellite in orbit
- \_\_\_\_\_ 9. a car maintaining a constant speed on a straight road
- \_\_\_\_\_ 10. an airplane landing

**Key Concept Builder** 

**LESSON 2**

## Newton's First Law

**Key Concept** What effect does inertia have on the motion of an object?

**Directions:** Read the scenario. Then answer the question on the lines provided.

At a bowling alley, people bowl while a storm howls outside. Suddenly, a side door of the building is blown open and a strong wind sweeps through the alley. The wind scatters many objects, but the bowling balls rolling down the lanes are unaffected.

1. Why did the wind entering the bowling alley scatter many objects but have no effect on the bowling balls?

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**Directions:** On each line, write the term that correctly completes each sentence.

2. The tendency of an object to resist a change in its motion is called \_\_\_\_\_.
3. That tendency and the force of \_\_\_\_\_ affect an object's motion.