

## Newton's 3<sup>rd</sup> Law: True or False

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

*Determine if the following statements are true or false.*

- \_\_\_\_\_ 1. Forces always act in pairs.
- \_\_\_\_\_ 2. Action and reaction forces always cancel out.
- \_\_\_\_\_ 3. Action and reaction forces always result in motion.
- \_\_\_\_\_ 4. Only moving objects have momentum.
- \_\_\_\_\_ 5. A smaller mass cannot have as much momentum as a larger mass.
- \_\_\_\_\_ 6. Momentum can be transferred from one object to another.
- \_\_\_\_\_ 7. When an action and reaction occur, momentum is usually lost.
- \_\_\_\_\_ 8. Momentum is conserved only in head-on collisions.
- \_\_\_\_\_ 9. Newton's third law of motion is also called the law of conservation of momentum.
- \_\_\_\_\_ 10. Momentum is another term for acceleration.

## Critical Reading

*Read this passage from the text and answer the questions that follow.*

### Action and Reaction

Newton's third law of motion states that every action has an equal and opposite reaction. This means that forces always act in pairs. First an action occurs, such as two skateboarders pushing together. Then a reaction occurs that is equal in strength to the action but in the opposite direction. In the case of the skateboarders, they move apart, and the distance they move depends on how hard they first pushed together.

You might think that actions and reactions would cancel each other out like balanced forces do. Balanced forces, which are also equal and opposite, cancel out because they act on the same object. Action and reaction forces, in contrast, act on different objects, so they don't cancel out. In fact, they often result in motion.

### Questions

1. What is Newton's third law of motion?
  
  
  
  
  
  
  
  
  
  
2. Describe an example of an action and reaction that result in motion.

3. Compare and contrast action-reaction forces and balanced forces.

### **Multiple Choice**

*Circle the letter of the correct choice.*

1. When an action force occurs, the reaction force is always
  - a. in the same direction as the action force.
  - b. equal and opposite to the action force.
  - c. applied to the same object as the action force.
  - d. two of the above
2. When you stand on the floor, the force of your body pushing down on the floor is
  - a. matched by the floor pushing up on your body.
  - b. less than the reaction force applied by the floor.
  - c. a reaction to the floor pushing up.
  - d. none of the above
3. When a kangaroo jumps, the kangaroo's action force acts on the ground and the reaction force
  - a. is exerted by the ground.
  - b. acts on the kangaroo.
  - c. is greater than the action force.
  - d. two of the above
4. If the following objects are all moving at the same velocity, which of the objects has the greatest momentum?
  - a. pea
  - b. marble
  - c. volleyball
  - d. bowling ball

5. Momentum is directly related to
- mass.
  - velocity.
  - distance.
  - two of the above
6. Momentum is a
- force of nature.
  - form of energy.
  - property of an object.
  - measure of an object's motion.
7. What is the momentum of a 9-kilogram object that has a velocity of 3 m/s?
- 3 kg/m/s
  - 6 kg/s/m
  - 12 kg • s/m
  - 27 kg • m/s

## Matching

*Match each definition with the correct term.*

### Definitions

- \_\_\_\_\_ 1. how to calculate momentum
- \_\_\_\_\_ 2. SI unit for momentum
- \_\_\_\_\_ 3. equal and opposite forces that act on different objects
- \_\_\_\_\_ 4. combined momentum of objects remains the same when an action-reaction occurs
- \_\_\_\_\_ 5. property of a moving object that makes it hard to stop
- \_\_\_\_\_ 6. equal and opposite forces that act on the same object
- \_\_\_\_\_ 7. every action has an equal and opposite reaction

### Terms

- momentum
- Newton's third law of motion
- balanced forces

- d.  $\text{kg} \cdot \text{m/s}$
- e. law of conservation of momentum
- f. action-reaction forces
- g. mass  $\times$  velocity

### **Fill in the Blank**

*Fill in the blank with the appropriate term.*

1. Two objects with the same mass have the same momentum only if they also have the same \_\_\_\_\_.
2. If a very massive object is stationary, its momentum is \_\_\_\_\_.
3. A 20-kg object moving at a velocity of 3 m/s has a momentum of \_\_\_\_\_.
4. For every action, there is an equal and \_\_\_\_\_ reaction.
5. Action and reaction forces are not balanced forces because they act on \_\_\_\_\_ objects.
6. When moving objects collide, their combined \_\_\_\_\_ is conserved.
7. If you double the mass of a moving object, the object's momentum \_\_\_\_\_.

### **Critical Writing**

*Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.*

Apply Newton's third law of motion to explain movements of a soccer ball during a game of soccer.