Chapter 06 Multi-format Test

Modified True/False
*Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.*

___ 1. The inertia of an object is determined by its *acceleration*. _________________________

___ 2. The “law of inertia” is a name sometimes used to refer to Newton’s *second* law. _________________________

___ 3. A force is an action that can change an object’s *mass*. _________________________

___ 4. The sum of all forces acting on an object is given the name *normal force*. _________________________

___ 5. The acceleration of an object is inversely related to the *mass*. _________________________

___ 6. *Momentum* is the mass of an object times its velocity. _________________________

___ 7. The law of conservation of *energy* can be used to predict motion of interacting objects after they collide. _________________________

Completion
*Complete each statement.*

Select the correct term to complete each sentence. There are extra terms in the list.

<table>
<thead>
<tr>
<th>first</th>
<th>second</th>
<th>third</th>
</tr>
</thead>
<tbody>
<tr>
<td>energy</td>
<td>momentum</td>
<td>equal</td>
</tr>
<tr>
<td>greater than</td>
<td>less than</td>
<td>inertia</td>
</tr>
<tr>
<td>net</td>
<td>unbalanced</td>
<td>equilibrium</td>
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</tbody>
</table>

8. An object at rest tends to stay at rest and an object in motion tends to stay in motion in a straight line summarizes a portion of Newton’s ____________________ law.

9. The property of an object that resists a change in its motion is called ____________________.

10. Any action that is able to change the motion of a body is called a ____________________.

11. The speed of a moving object will increase if the force acting upon it is ____________________.

12. The scientific law that states that every action force causes a reaction force of equal size in the opposite direction is Newton’s ____________________ law.

13. Every force creates a reaction force that is ____________________ in strength and opposite in direction.
Matching

Each question gives a daily life scenario about objects in motion and at rest. Decide which of Newton’s three laws of motion best applies to each situation.

a.  Newton’s first law  
   b.  Newton’s second law  
   c.  Newton’s third law

___ 15. A boat moves through the water because of a rowing motion (using oars).
___ 16. A dropped basketball hits the floor and bounces back up.
___ 17. It takes more force to accelerate a loaded dump truck than it takes to accelerate a small car with one passenger.
___ 18. Spin a raw egg on the table, stop it with your hand, and remove your hand quickly. The egg will begin to spin again with no help at all!

Short Answer

19. A high speed train, full of passengers, is waiting at a station. If the train suddenly accelerates rapidly, what will the passengers experience? Which of Newton’s laws applies to the passengers’ experience?
20. Why will a golf ball accelerate faster than a bowling ball when struck by a golf club?
21. Arrange the expression of Newton’s second law in a formula to solve for mass of an object if you know the force applied to the object and you know the acceleration of the object.
22. A carpenter pounds a 0.005-kilogram nail into a board using a 1.000-kilogram hammer. If the hammer applies a force of 50 newtons on the hammer, what force does the nail apply on the hammer?
23. Give three examples of action-reaction force pairs.
24. When you walk, you push against the ground with your feet. What pushes you and allows you to move forward? Use Newton’s third law to explain walking.

Problem

Answer the questions based on the following statement. Jackie has a mass of 50 kilograms and her baby sister has a mass of 10 kilograms.

25. How does Jackie’s inertia compare to her sister’s inertia?
26. Is Jackie’s mass directly proportional to her inertia, or is her mass inversely proportional to her inertia? Explain your answer.
27. Tom pushes on a 50-kilogram box with a force of 25 newtons. Assuming the surface on which the box moves is frictionless, at what rate does the box accelerate?
28. A 50-kilogram boy standing on a friction-free skateboard throws a 5.0-kilogram ball backward off the skateboard at a speed of 10 meters per second. At what speed does the boy move forward?
Essay

29. Toby, a truck driver, claims that if he were able to drive his twelve-ton truck on the Moon, it would require less force to bring it to a stop than on Earth. Is Toby right or wrong? Use the words weight, mass, and inertia to explain your answer.

30. Brianna starts a lawnmower moving across the yard by applying a force of 75 newtons on the handle of the mower. According to Newton’s third law, the handle pushes back on Brianna with 75 newtons of force. Why does the mower move if the forces are equal and opposite?
Chapter 06 Multi-format Test
Answer Section

MODIFIED TRUE/FALSE

1. ANS: F, mass
   DIF: basic  REF: section 6.1
2. ANS: F
   first
   1st
   DIF: basic  REF: section 6.1
3. ANS: F, motion
   DIF: basic  REF: section 6.1
4. ANS: F, net
   DIF: basic  REF: section 6.1
5. ANS: T
   DIF: basic  REF: section 6.2
6. ANS: T
   DIF: basic  REF: section 6.3
7. ANS: F, momentum
   DIF: basic  REF: section 6.3

COMPLETION

8. ANS: first
   DIF: basic  REF: section 6.1
9. ANS: inertia
   DIF: basic  REF: section 6.1
10. ANS: force
    DIF: basic  REF: section 6.1
11. ANS: unbalanced
    DIF: intermediate  REF: section 6.1
12. ANS: third
    DIF: basic  REF: section 6.3
13. ANS: equal
    DIF: basic  REF: section 6.3
MATCHING

14. ANS: A  DIF: intermediate  REF: section 6.1
15. ANS: C  DIF: intermediate  REF: section 6.3
16. ANS: C  DIF: intermediate  REF: section 6.3
17. ANS: B  DIF: intermediate  REF: section 6.2
18. ANS: A  DIF: intermediate  REF: section 6.1

SHORT ANSWER

19. ANS: The passengers will remain at rest relative to the train car, and since the train is rapidly accelerating, they will feel as if they are being pushed into the backs of their seats. Newton’s first law applies to this situation, because the passengers at rest remain at rest.

DIF: intermediate  REF: section 6.1

20. ANS: The golf ball has less inertia due to lower mass and will accelerate faster.

DIF: intermediate  REF: section 6.1

21. ANS: mass = \frac{\text{force}}{\text{acceleration}}

DIF: intermediate  REF: section 6.2

22. ANS: 50 newtons

DIF: intermediate  REF: section 6.3

23. ANS: Answers may vary. Sample answers include:
   a. The Sun pulling on Earth, and Earth pulling on the Sun.
   b. A soccer player’s foot striking the ball, and the ball hitting the foot.
   c. An ax striking a log, and the log contacting the ax.

DIF: intermediate  REF: section 6.3

24. ANS: When we walk, we exert a force on the ground with our feet. The ground exerts an equal and opposite reaction force back on our feet that moves us. It is the reaction from the ground that makes walking possible.

DIF: advanced  REF: section 6.3

PROBLEM

25. ANS: Jackie’s inertia is 5 times greater than her sister’s.

DIF: intermediate  REF: section 6.1
26. **ANS:**
Directly proportional, because as her mass increases, so does her inertia.

**DIF:** intermediate  **REF:** section 6.1

27. **ANS:**

\[
\text{force} = \text{mass} \times \text{acceleration}
\]

\[
\text{acceleration} = \frac{\text{force}}{\text{mass}} = \frac{25 \text{ newtons}}{50 \text{ kilograms}}
\]

\[
\text{acceleration} = 0.5 \text{ N/kg or } 0.5 \text{ m/s}^2
\]

**DIF:** intermediate  **REF:** section 6.2

28. **ANS:**

\[
\text{momentum of ball} = \text{momentum of boy}
\]

\[
\text{mass of ball} \times \text{speed of ball} = \text{mass of boy} \times \text{speed of boy}
\]

\[
(5.0 \text{ kg}) \times (10 \text{ m/s}) = (50 \text{ kg}) \times \text{speed of boy}
\]

\[
\text{speed of boy} = 1 \text{ m/s}
\]

**DIF:** intermediate  **REF:** section 6.3

**ESSAY**

29. **ANS:**
Toby is wrong. The truck will require the same amount of force on the Moon to stop it. Inertia is the property of matter that resists a change in the motion of an object. Inertia comes from mass. Although his truck weighs about two tons on the Moon, its mass is the same and has the same amount of inertia on the Moon as it does on Earth, requiring the same force to stop it in both locations.

**DIF:** advanced  **REF:** section 6.1

30. **ANS:**

Answers may include:
The forces are acting on different objects and do not cancel one another. The force has a larger effect on the mower because Brianna has a larger mass, which is more difficult to accelerate, so the mower is accelerated in the direction that Brianna is pushing.

**OR**

Brianna pushes on the ground with her feet and the ground pushes on Brianna. At the same time, the mower pushes on the ground, and the ground pushes on the mower. The mower moves because the ground is pushing Brianna forward harder than the ground is pushing the mower back. The unbalanced forces cause the mower to move forward.

**DIF:** advanced  **REF:** section 6.3
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