

Chapter 3 Newton's First Law of Motion—Inertia

Exercises

3.1 Aristotle on Motion (pages 29–30)

Fill in the blanks with the correct terms.

1. Aristotle divided motion into two types: natural motion and violent motion.
2. Natural motion on Earth was once thought to be either straight up or straight down.
3. Aristotle thought that it was natural for heavy things to fall and for light things to rise.
4. Aristotle also thought that circular motion was natural for objects beyond Earth and that the planets and stars moved in perfect circles around Earth.
5. What force was thought to have caused a horse and cart to experience violent motion? the pull of the horse
6. Before the 1500s, the proper state of objects was thought to be one of rest, unless they were being pushed or pulled or were moving toward their natural resting place.
7. Is the following statement true or false? Early thinkers thought that violent motion was imposed motion. true
8. Is the following statement true or false? It was commonly thought by many ancient thinkers that if an object moved “against its nature,” then a force of some kind was responsible. true

3.2 Copernicus and the Moving Earth (page 30)

Determine if each of the following statements is true or false.

- true 9. Copernicus thought that Earth and other planets move around the sun.
- false 10. Copernicus thought that Earth was at the center of the universe.
- true 11. Copernicus did not publish his ideas until he was near death.
- false 12. Copernicus lived a long and happy life after his works were published.
13. Why did Copernicus do most of his work in secret?
Copernicus' ideas were very controversial, so he worked in secret to avoid persecution.

3.3 Galileo on Motion (pages 30–32)

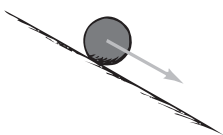
14. What was one of Galileo's great contributions to physics?
demolishing the notion that a force is necessary to keep an object moving
15. A force is any push or pull.

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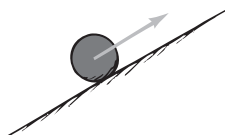
16. Explain what friction is and how it acts.

Friction is the force that acts between materials that touch as they move past each other.
Friction is caused by irregularities in the surfaces that are touching. All irregularities obstruct motion causing a force (friction) that opposes motion.

17. In the drawings below, describe each type of slope on the top line. On the bottom line, describe the slope's affect on speed.



a. Slope downward
Speed increases



b. Slope upward
Speed decreases



c. No slope
Speed does not change

18. Based on his experiments with rolling balls, Galileo was able to conclude that when friction is present, a force is needed to keep an object moving.

19. Describe the property of inertia in your own words.

A body in motion will stay in motion unless acted on by a force. Likewise, a body at rest will stay at rest unless acted on by a force. Or, every object resists change to its state of motion.

3.4 Newton's Law of Inertia (pages 33–35)

20. What is another name for Newton's first law of motion?

the law of inertia

21. State Newton's first law of motion.

Newton's first law states that every object continues in a state of rest, or of uniform speed in a straight line, unless it is acted on by a nonzero net force.

22. Use Newton's first law of motion to explain what happens to dishes on a table when the tablecloth is quickly pulled from beneath them.

Dishes on a tabletop are at rest. They tend to remain at rest even when the tablecloth is pulled from beneath them because friction between the dishes and the tablecloth is not significant enough to move the dishes very much.

23. Objects in a state of rest tend to remain at rest; only a force will change that state.

24. Use Newton's first law of motion to explain why an air hockey puck slides on the game table with no apparent loss in speed. Name two things that can cause the puck to change its state of motion.

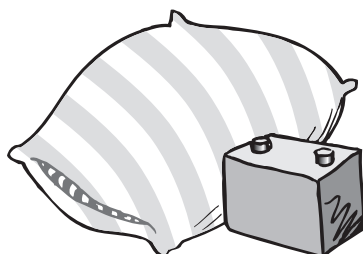
In the absence of forces, a moving object such as the air hockey puck will move indefinitely in a straight line. The puck will change its motion if it is struck or if it hits the side of the playing table.

25. Once an object is moving in a force-free environment, for how long will it move in a straight line? indefinitely

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3.5 Mass—A Measure of Inertia (pages 36–38)

26. Circle the letter of each sentence that is true about the mass of an object.
- a. The amount of inertia an object has depends on its mass.
 - b. The more mass an object has, the greater its inertia.
 - c. Volume and mass are the same quantity.
 - d. Mass is usually measured in kilograms.
27. Which item below has more mass? Which has more volume? Which has the greater inertia?



The battery has greater mass and thus greater inertia. The pillow has greater volume.

28. Is the following sentence true or false? Mass is a measure of the gravitational force acting on an object. false
29. Mass is a measure of the amount of material in an object and depends on the number of and kind of atoms that compose it.
30. Is the following sentence true or false? A stone has the same mass on Earth and on the moon, but its weight is less on the moon. true
31. Mass is the quantity of matter in an object.
32. Weight is the force of gravity on an object.

Match each phrase with the correct word.

Phrase	Word
<u>c</u> 33. traditional unit of weight in the United States	a. kilogram
<u>b</u> 34. measure of matter in most parts of the world	b. mass
<u>a</u> 35. SI unit of mass	c. pound
<u>d</u> 36. SI unit of force	d. newton

3.6 The Moving Earth Again (pages 38–39)

37. If Earth is rotating at 30 km/s, explain how a bird sitting on a tree can drop down vertically and grab a worm that is crawling on the ground. Earth, the bird, the tree, the ground, and the worm are all rotating as one unit. Because everything is rotating as one unit, Earth’s rotation does not affect the bird’s ability to descend vertically to grab the worm.

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38. A girl is sitting on a bus that is traveling at 30 km/h. She is throwing her tennis ball gently into the air and catching it. Circle the letter of each true statement.
- a. The tennis ball is moving faster than the girl riding on the bus.
 - b.** The tennis ball is behaving as if the bus were at rest.
 - c. The inertia of the tennis ball changes when it is thrown.
 - d.** Gravity affects only the vertical motion of the tennis ball.

Match the ideas on motion with the correct scientist.

Idea	Scientist
<u> a </u> 39. did not recognize inertia	a. Aristotle
<u> b </u> 40. developed the law of inertia	b. Newton
<u> a </u> 41. believed that horizontal motion was "unnatural"	c. Galileo
<u> c </u> 42. was one of the first to recognize that no force was needed to keep an object in motion	