

Name: _____
Mr. Willis
Conceptual Physics: _____
Date: _____

Unit III
Forces and Motion (Newton's Laws)
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Unit III Study Guide

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

_____ 1. The SI unit of force is the

- a. joule.
- b. kilogram.
- c. meter.
- d. newton.

_____ 2. Which of the following relationships is correct?

- a. $1 \text{ N} = 1 \text{ kg}$
- b. $1 \text{ N} = 1 \text{ kg}\cdot\text{m}$
- c. $1 \text{ N} = 1 \text{ kg}\cdot\text{m}/\text{s}$
- d. $1 \text{ N} = 1 \text{ kg}\cdot\text{m}/\text{s}^2$

_____ 3. When an unbalanced force acts on an object,

- a. the object's motion does not change.
- b. the object accelerates.
- c. the weight of the object decreases.
- d. the inertia of the object increases.

_____ 4. When a pair of balanced forces acts on an object, the net force that results is

- a. greater in size than both forces combined.
- b. greater in size than one of the forces.
- c. equal in size to one of the forces.
- d. equal to zero.

_____ 5. What kind of friction occurs as a fish swims through water?

- a. Fluid
- b. Rolling
- c. sliding
- d. static

_____ 6. As you push a cereal box across a tabletop, the sliding friction acting on the cereal box

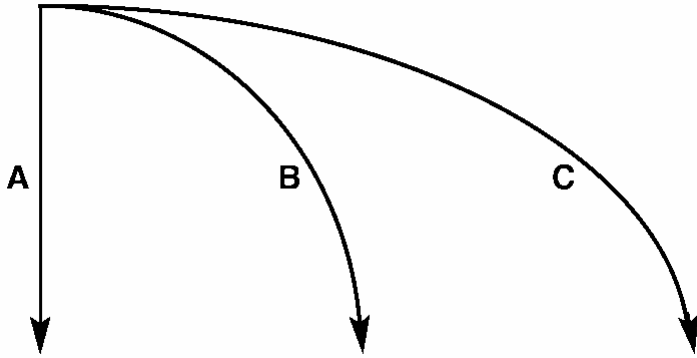
- a. acts in the direction of motion.
- b. Equals the weight of the box.
- c. Is usually greater than static friction.
- d. acts in the direction opposite of motion.

_____ 7. The forces acting on a falling leaf are

- a. air resistance and fluid friction.
- b. Gravity and air resistance.
- c. gravity and static friction.
- d. weight and rolling friction.

_____ 8. An open parachute increases air resistance of a falling sky diver by

- a. decreasing the weight of the diver.
- b. increasing surface area.
- c. increasing the terminal velocity.
- d. reducing fluid friction.

**Figure 12-1**

- ___ 9. Figure 12-1 shows the motion of three balls. The curved paths followed by balls B and C are examples of
- centripetal motion.
 - constant motion.
 - linear motion.
 - projectile motion.
- ___ 10. Projectile motion is caused by
- the downward force of gravity.
 - an initial forward velocity.
 - a final vertical velocity.
 - the downward force of gravity and an initial forward velocity.
- ___ 11. The property of matter that resists changes in motion is called
- friction.
 - gravity.
 - inertia.
 - weight.
- ___ 12. An orange might roll off your cafeteria tray when you stop suddenly because of
- the balanced forces acting on the orange.
 - the centripetal force acting on the orange.
 - the friction forces acting on the orange.
 - the orange's inertia.
- ___ 13. According to Newton's second law of motion, the acceleration of an object equals the net force acting on the object divided by the object's
- mass.
 - momentum.
 - velocity.
 - weight.
- ___ 14. If a force of 12 N is applied to an object with a mass of 2 kg, the object will accelerate at
- 0.17 m/s^2 .
 - 24 m/s^2 .
 - 6 m/s^2 .
 - 12 m/s^2 .
- ___ 15. Your weight equals your
- mass.
 - mass divided by the net force acting on you.
 - mass times the acceleration due to gravity.
 - mass times your speed.

___ 16. The acceleration due to gravity on the surface of Mars is about one third the acceleration due to gravity on Earth's surface. The weight of a space probe on the surface of Mars is about

- a. nine times greater than its weight on Earth's surface.
- b. three times greater than its weight on Earth's surface.
- c. one third its weight on Earth's surface.
- d. the same as its weight on Earth's surface.

___ 17. Newton's third law of motion describes

- a. action and reaction forces.
- b. balanced forces.
- c. centripetal forces.
- d. net force.

___ 18. In which of the following are action and reaction forces involved?

- a. when a tennis racket strikes a tennis ball
- b. when stepping from a curb
- c. when rowing a boat
- d. all of the above

___ 19. The product of an object's mass and velocity is its

- a. centripetal force.
- b. momentum.
- c. net force.
- d. weight.

___ 20. What is conserved when two objects collide in a closed system?

- a. acceleration
- b. momentum
- c. speed
- d. velocity

___ 21. What is the momentum of a 50-kilogram ice skater gliding across the ice at a speed of 5 m/s?

- a. $10 \frac{\text{kg}}{\text{m/s}}$
- b. 500 kg·m/s
- c. 50 kg
- d. 250 kg·m/s

___ 22. What force is responsible for the repulsion between two positively-charged particles?

- a. centripetal
- b. Electric
- c. gravitational
- d. nuclear

___ 23. When opposite poles of two magnets are brought together, the poles

- a. attract each other.
- b. repel each other.
- c. cancel each other.
- d. cause a net force of zero.

___ 24. Which universal force acts only on the protons and neutrons in a nucleus?

- a. Electric
- b. gravitational
- c. magnetic
- d. strong nuclear

___ 25. With which of the following is the weak nuclear force associated?

- a. lightning
- b. nuclear decay
- c. ocean tides
- d. static cling

___ 26. Which of the following universal forces is the weakest?

- a. Electric
- b. gravitational
- c. magnetic
- d. strong nuclear

- ____ 27. As an astronaut travels far away from Earth, her weight
- decreases because gravity decreases.
 - decreases because her mass decreases.
 - increases because gravity increases.
 - Remains the same because her mass remains the same.
- ____ 28. The gravitational force between two objects increases as mass
- decreases or distance decreases.
 - decreases or distance increases.
 - increases or distance decreases.
 - increases or distance increases.
- ____ 29. The force that keeps an object moving in a circle is called
- centripetal force.
 - fluid friction.
 - inertia.
 - momentum.
- ____ 30. The centripetal force acting on a satellite in orbit
- acts as an unbalanced force on the satellite.
 - Changes the direction of the satellite.
 - is a center-directed force.
 - all of the above

Completion

Complete each sentence or statement.

31. A push or pull is an example of a(an) _____.
32. The type of force measured by a grocery store spring scale is _____.
33. The sum of all the forces acting on an object is called the _____.
34. If the forces acting on an object produce a net force of zero, the forces are called _____.
35. The force that opposes the motion of objects that touch as they move past each other is called _____.
36. It usually takes more force to start an object sliding than it does to keep an object sliding because static friction is usually _____ than sliding friction.
37. The two forces acting on a falling object are gravity and _____.
38. When a falling object reaches terminal velocity, the net force acting on it is _____.
39. The drag force acting on a falling sky diver is also known as _____.
40. The path of motion of a thrown javelin is an example of _____ motion.
41. The tendency of an object to resist any change in its motion is called _____.
42. During a head-on auto collision, _____ causes a passenger in the front seat to continue moving _____.
43. The acceleration of an object is equal to the net _____ acting on the object divided by the object's _____.
44. The force of gravity acting on an object is the object's _____.

45. If a golf ball and bowling ball are rolling at the same speed, the _____ ball has greater momentum.
46. When you push on a wall, the _____ pushes back on you.
47. In a closed system, the loss of momentum of one object _____ the gain in momentum of another object.
48. The observation that a charged object can attract or repel other charged objects led scientists to conclude that there are _____ types of charges.
49. The universal force that is effective over the longest distances is _____.
50. The centripetal force acting on the moon continuously changes the _____ of the moon's motion.

Short Answer

51. How can an arrow be used to represent the size and direction of a force?
52. What happens to the magnitude of the fluid friction acting on a submarine as the submarine's speed increases?

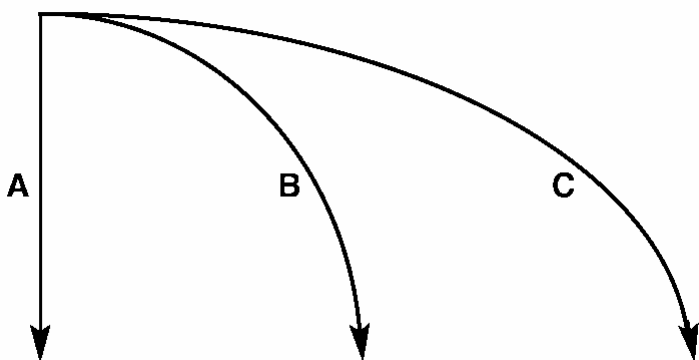


Figure 12-1

53. Figure 12-1 shows the paths followed by three balls. Each ball started moving at the same time. Ball A was dropped and balls B and C were thrown sideways. Compare the times for each ball to reach the ground.
54. What is the direction of the net force on a falling sky diver before she reaches terminal velocity? After she is falling at terminal velocity?
55. How can you double the acceleration of an object if you cannot alter the object's mass?
56. During a collision, a seat belt slows the speed of a crash-test dummy. What is the direction of the net force exerted by the seat belt compared to the direction of the dummy's motion?
57. How are the size and direction of action-reaction forces related?
58. Why don't action-reaction forces cancel each other?

59. What law states that if no net force acts on a system, then the total momentum of the system does not change?
60. A billiard ball with a momentum of 20 kg·m/s strikes a second ball at rest and comes to a complete stop. What is the change in momentum of the second ball?
61. Compare the speed of a moving golf ball with the speed of a moving bowling ball if both balls have the same amount of momentum.
62. Electric force and magnetic force are the only forces that can both do what?
63. One end of a bar magnet attracts one end of a second bar magnet. What will happen if the second bar magnet is reversed?
64. Which of the universal forces acts only on protons and neutrons in the nucleus of an atom?
65. What is the primary cause of Earth's ocean tides?

Problem

66. A tow truck exerts a net horizontal force of 1050 N on an 760-kilogram car. What is the acceleration of the car during this time? Show your work.
67. The mass of a newborn baby is 3.5 kilograms. What is the baby's weight? (The acceleration due to gravity at Earth's surface is 9.8 m/s^2 .) Show your work.
68. A 38-kilogram canoe broke free of its dock and is now floating downriver at a speed of 2.2 m/s. What is the canoe's momentum? Show your work.
69. A small engine causes a 0.3-kg model airplane to accelerate at a rate of 11 m/s^2 . What is the net force on the model airplane? Show your work.

Essay

70. Why does a biker have to pedal harder to travel at a constant speed into the wind on a windy day compared to traveling on the same road at the same speed on a calm day?

Other

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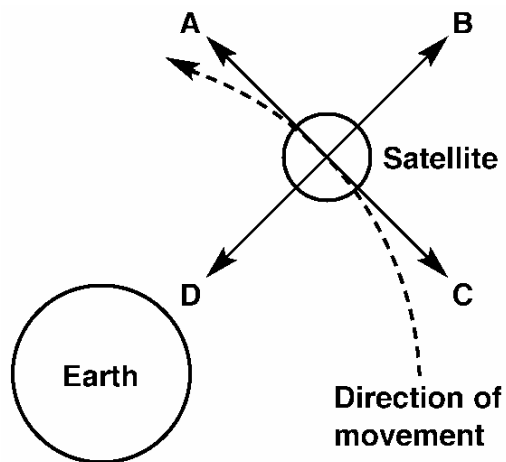


Figure 12-2

71. In Figure 12-2, what is the direction of the centripetal force acting on the satellite at this location in its orbit?
72. What happens to the size of the centripetal force due to gravity acting on the satellite in Figure 12-2 if the satellite moves farther from Earth?
73. The centripetal force acting on the satellite in Figure 12-2 is one of a pair of action-reaction forces. On what object is the other force in the pair acting?
74. In Figure 12-2, what property of the satellite tends to keep it moving along through its orbit?
75. As shown in Figure 12-2, what is the direction of the fluid friction acting on the satellite as it moves through the outer layer of Earth's atmosphere?

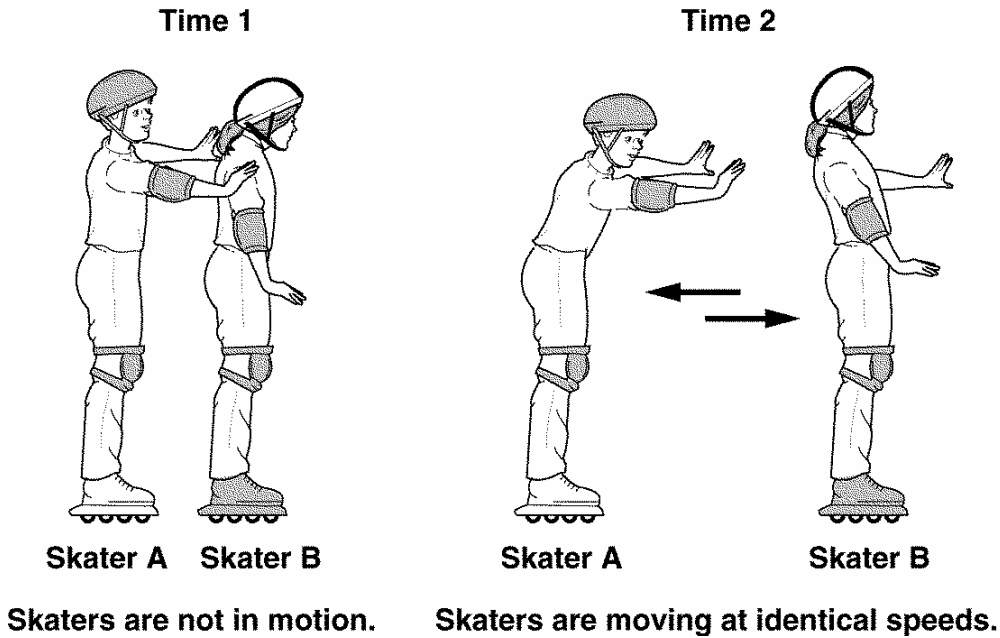


Figure 12-3

76. In Figure 12-3, what is the momentum of each skater at Time 1?
77. In Figure 12-3, compare the size and direction of the momentums of both skaters immediately after the push shown at Time 2.
78. In Figure 12-3, describe the motion of Skater B after Skater A pushes her.
79. In Figure 12-3, if Skater A is pushing Skater B, why does Skater A move?
80. Suppose that the skaters repeat the demonstration in Figure 12-3 again. This time Skater B is holding a 10-kilogram mass. If Skater A pushes exactly as he did the first time, will Skater A's motion be different this time? Explain your answer.