7 The Laws of Motion

Name _____

Worksheet A: Concepts & Calculations

Inquiry Physics

In the space to the left, write the answer that best completes the statement.

_____ 1. _____ was prominent in the development of **kinematics** with his experiments to describe how things moved.

_____ 2. _____ was prominent in the development of **dynamics** with his statements showing the connections between acceleration, force, and mass.

_____ 3. _____ is the property of an object which causes it to resist all changes in its state of motion.

_____ 4. Unless acted upon by a(n) _____ _____, an object at rest or in a state of uniform motion will remain at rest or in uniform motion.

_____ 5. An object will _____ when an unbalanced force acts on it.

_____ 6. A net force of one _____ will make a 1 kg mass accelerate at 1 m/s^2.

_____ 7. Acceleration varies directly with the applied _____ if the _____ is constant.

_____ 8. Acceleration varies inversely with the _____ if the _____ is constant.

_____ 9. _____ is a measurement of the gravitational force acting on an object.

_____ 10. _____ is a measurement of an object's inertia and depends upon the amount of matter in the object.

_____ 11. The _____ balance, unlike most others, does not rely upon weight to measure an object's mass.

_____ 12. Every force is accompanied by a(n) _____ and _____ force.

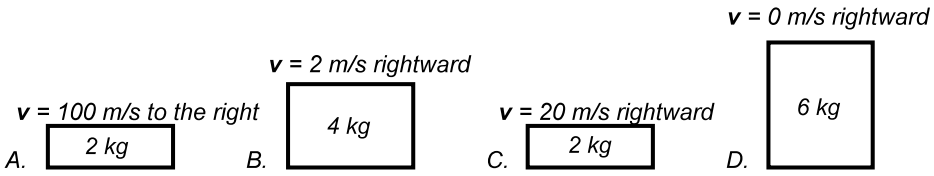
In the space to the left, write the letter of the best answer to each question.

_____ 13. Which is an example of an object moving in a direction opposite the net force on it?
A. free-fall projectile in upward flight
B. free-fall projectile in downward flight
C. vehicle accelerating forward from a stop
D. none of these; motion is always in the direction of the net force

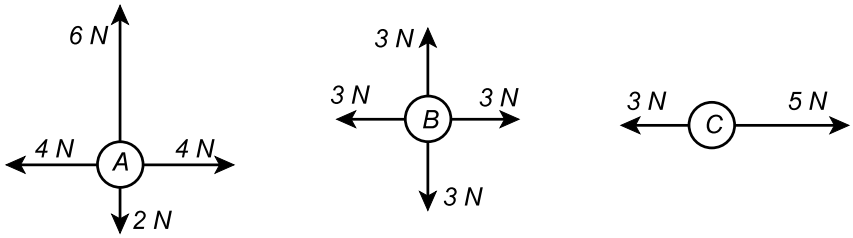
_____ 14. When a soccer player kicks a ball, how do the sizes of the forces compare?
A. force of ball on foot > force of foot on ball
B. force of foot on ball > force of ball on foot
C. force of foot on ball = force of ball on foot
D. answer varies depending on how hard the player kicks the ball

_____ 15. When it lifts off, which statement best describes a rocket's action/reaction?
A. Its exhaust pushing down is the action, its movement upward the reaction.
B. Its exhaust pushing down on the air is the action; the air pushing up on the rocket is the reaction.
C. The fuel's explosion pushes upward on the rocket; the rocket pushes down against the explosion.
D. The fuel's explosion pushes downward; the rocket pushes upward against the explosion.

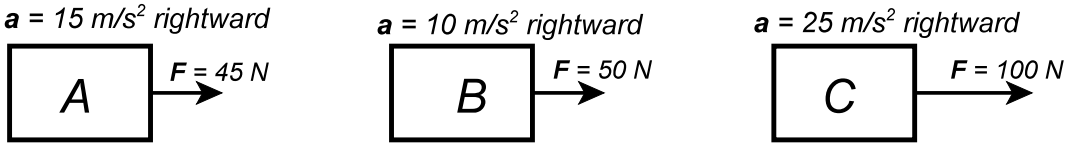
_____ 16. Which of these objects has the greatest inertia?



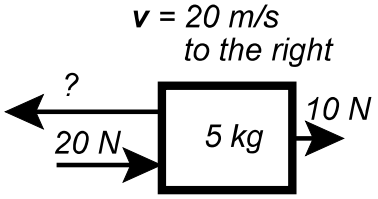
_____ 17. Which object could be moving at a constant velocity if the only forces acting at this time are those shown in the diagram?



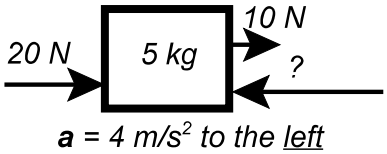
_____ 18. Which object is the most massive?



_____ 19. What is the magnitude of the missing force in the figure at right?
A. 10 N B. 20 N C. 30 N D. 40 N



_____ 20. What is the magnitude of the missing force in the figure at right?
A. 10 N B. 30 N C. 50 N D. 70 N



21. **Identify the objects and force directions for the action-reaction pairs in the following situations:**

Situation	Action	Reaction
Example: A softball player catches a ball.	The ball pushes the player's hand/mitt backward.	The player's hand/mitt pushes the ball forward.
A girl takes a forward step.		
A gust of wind strikes a window.		
A cat is in free-fall (ignore air resistance).		

Show your work, including all appropriate equations and units. Express your answer with the proper number of significant figures.

22. A student is standing still at the doctor's office. The doctor says she weighs 145 pounds. What is her mass in slugs? (Show your equation and all work, using only English units, including sl = slugs; lbs = pounds; and g = 32.2 ft/s^2)

23. Draw a free-body diagram of the student in problem 22.

24. A speedboat has a mass of 500 kg. It starts from rest and travels 200 m in 12.0 s. The boat undergoes constant acceleration during the 12.0 s. What is the size of the unbalanced force on the boat?

25. A ball starts from rest and acquires a speed of 12.0 m/s when a horizontal force is applied over a distance of 0.500 m. If the ball has a mass of 1.00 kg, what is the amount of force applied?

26. An 80.0 kg person travelling at 3.00 m/s on ice skates experiences a backward force of 40.0 N for 4.00 seconds. What is the **size** and **direction** of the person's new velocity?

27. We can use $F_g = mg$ to predict weights on other planets, if we substitute the usual Earth g of 9.8 m/s^2 with the appropriate value of g for the other planet.

    a. An object weighs 750. N on Earth. Compute the object's mass.

    b. Calculate that object's weight on the planet Mercury, which has an acceleration due to gravity of only 3.70 m/s^2.

