

SUMMARY OF TERMS (KNOWLEDGE)

Force Any push or pull exerted on an object, measured in newtons (or pounds in the British system).

Friction The resistive force that opposes the motion or attempted motion of an object either past another object with which it is in contact or through a fluid.

Mass The quantity of matter in an object. More specifically, it is the measure of the inertia or sluggishness that an object exhibits in response to any effort made to start it, stop it, deflect it, or change in any way its state of motion.

Weight The force upon an object due to gravity, mg . (More generally, the force that an object exerts on a means of support.)

Kilogram The fundamental SI unit of mass. One kilogram (symbol kg) is the mass of 1 liter (1 L) of water at 4°C.

Newton The SI unit of force. One newton (symbol N) is the force that will give an object of mass 1 kg an acceleration of 1 m/s².

Volume The quantity of space an object occupies.

Newton's second law The acceleration of an object is directly proportional to the net force acting on the object, is in the direction of the net force, and is inversely proportional to the mass of the object.

Free fall Motion under the influence of gravitational pull only.

Terminal speed The speed at which the acceleration of a falling object terminates because air resistance balances gravitational force.

Terminal velocity Terminal speed with direction specified.

READING CHECK QUESTIONS (COMPREHENSION)**4.1 Force Causes Acceleration**

1. Is acceleration proportional to net force, or does acceleration equal net force?

4.2 Friction

2. When you push horizontally on a crate on a level floor that doesn't slide, how great is the force of friction on the crate?
3. As you increase your push, will friction on the crate increase also?
4. Once the crate is sliding, how hard do you push to keep it moving at constant velocity?
5. Which is normally greater: static friction or sliding friction on the same object?
6. How does the force of friction for a sliding object vary with speed?
7. Does fluid friction vary with speed?

4.3 Mass and Weight

8. Which is more fundamental: *mass* or *weight*? Which varies with location?
9. Fill in the blanks: Shake something to and fro and you're measuring its _____. Lift it against gravity and you're measuring its _____.
10. Fill in the blanks: The Standard International unit for mass is the _____. The Standard International unit for force is the _____.
11. What is the approximate weight of a quarter-pound hamburger after it is cooked?
12. What is the weight of a 1-kilogram brick resting on a table?
13. In the string-pull illustration in Figure 4.8, a gradual pull of the lower string results in the top string breaking. Does this occur because of the ball's weight or its mass?

14. In the string-pull illustration in Figure 4.8, a sharp jerk on the bottom string results in the bottom string breaking. Does this occur because of the ball's weight or its mass?

15. Is acceleration *directly* proportional to mass, or is it *inversely* proportional to mass? Give an example.

4.4 Newton's Second Law of Motion

16. State Newton's second law of motion.
17. If we say that one quantity is *directly proportional* to another quantity, does this mean they are *equal* to each other? Explain briefly, using mass and weight as an example.
18. If the net force acting on a sliding block is somehow tripled, what happens to the acceleration?
19. If the mass of a sliding block is tripled while a constant net force is applied, by how much does the acceleration change?
20. If the mass of a sliding block is somehow tripled at the same time the net force on it is tripled, how does the resulting acceleration compare with the original acceleration?
21. How does the direction of acceleration compare with the direction of the net force that produces it?

4.5 When Acceleration Is g —Free Fall

22. What is the condition for an object experiencing *free fall*?
23. The ratio circumference/diameter for all circles is π . What is the ratio force/mass for freely falling bodies?
24. Why doesn't a heavy object accelerate more than a light object when both are freely falling?

4.6 When Acceleration Is Less Than g —Nonfree Fall

25. What is the net force that acts on a 10-N freely falling object?