

Newton's 1st Law – Inertia (43 total points)

Acceleration of gravity: $g = 10 \text{ m/s}^2$

$v = \Delta d / \Delta t$

$a = \Delta v / \Delta t$

$v_f = at$

$d = 1/2 at^2$

$v_{av} = (v_o + v_f) / 2$

For projectile motion (horizontal launch):

Horizontal
 $d = v \cdot t$

Vertical
 $h = 5t^2$

1.0 kg = 10 N = 2.2 lbs.

Choose the word that best describes the phrases given here and write it in the blank.

equilibrium friction force inertia kilogram mass net force Newton normal weight

- _____ 1. pull of gravity on an object
- _____ 2. the state of an object on which no net force acts
- _____ 3. a push or pull
- _____ 4. the combination of all the forces that act on an object
- _____ 5. the SI unit of force
- _____ 6. quantity of matter in an object
- _____ 7. measure of an object's inertia
- _____ 8. force that acts to resist the sliding of two objects across one another
- _____ 9. the SI unit of mass
- _____ 10. a line perpendicular to a surface
- _____ 11. the reluctance of any object to change its state of motion

Multiple Choice – Pick the best response

- ___ 1. A book weighing 12 N rests on a table top. The net force on the book is:
a. 0 N b. 6 N c. 12 N d. 24 N
- ___ 2. In referring to how much matter a body contains, we use the term:
a. volume b. mass c. weight
- ___ 3. A rock weighing 1 N is held in a child's hand. The net force acting on the rock is:
a. 0 N b. 0.1 N c. 1 N d. 10 N
- ___ 4. The child then throws the rock up into the air. As the rock ascends, the net force acting on it is:
a. 0 N b. 0.1 N c. 1 N d. 10 N
- ___ 5. Object **A** weighs 30 N on the earth, while object **B** weighs 30 N on the moon. Which has the greater mass?
a. A b. B c. both the same
- ___ 6. Which one(s) of these indicate that the net force on an object is zero?
a. speeding up b. slowing down c. constant speed in a circle d. constant speed in a straight line e. rest
- ___ 7. A tennis ball and a solid steel ball of the same diameter are dropped at the same time. On which ball is the force of gravity greater?
a. tennis ball b. steel ball c. same on both
- ___ 8. A tennis ball and a solid steel ball of the same diameter are dropped at the same time. Which ball will have the greater acceleration (ignore effects of air resistance)?
a. tennis ball b. steel ball c. both the same
- ___ 9. Inertia has to do with:
a. objects at rest b. objects in motion c. both d. neither

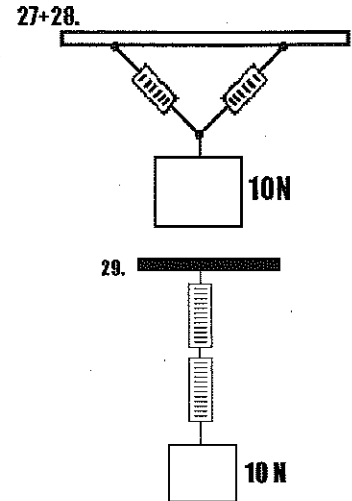
- ___ 10. If you were in a space ship and fired a 3.0 kg cannon ball into frictionless space, how much force would have to be exerted to keep the cannon ball moving?
a. no force b. 3.0 kg c. 30 N
- ___ 11. What would change if you brought a 3.0 kg cannon ball to the moon?
a. its mass b. its weight c. both d. neither
- ___ 12. A junk car is compressed to about one-third of its original height. What about the car has changed?
a. its mass b. its weight c. its volume d. a, b, and c e. none of the choices
- ___ 13. A hockey puck sliding across ice gradually slows down because of:
a. friction b. its inertia c. both d. neither
- ___ 14. The gravitational pull on an object is the object's:
a. mass b. inertia c. weight
- ___ 15. Which contains more iron?
a. a piece of iron with a mass of 1.0 kg b. a piece of iron with a weight of 10 N c. both the same
- ___ 16. Which has more mass?
a. 1.0 kg of air b. 1.0 kg of iron c. both the same
- ___ 17. Friction:
a. acts in a direction opposite to the motion
b. is the name given to the force acting on two objects sliding past one another
c. both
d. neither
- ___ 18. The law of inertia states that an object:
a. at rest will remain at rest unless acted upon by an outside force
b. will continue in motion at the same velocity unless an outside force acts on it
c. will stay moving in a straight line at constant speed unless an outside force acts on it
d. all of the above
e. none of the above
- ___ 19. The astronomer, Copernicus, was the first person to state publicly that the earth:
a. is the center of the solar system
b. does not move
c. is moving in a straight line
d. revolves around the sun
- ___ 20. Galileo found that a ball rolling down one inclined plane would roll how far up another inclined plane?
a. to nearly twice the original height
b. to nearly the original height
c. to nearly half the original height
d. to about $\frac{1}{4}$ the original height
- ___ 21. Galileo showed that if friction were not present:
a. moving objects would slow down anyway
b. balls rolling on a flat surface would slow down on their own
c. balls moving on a horizontal surface would move forever
- ___ 22. If you jump up in a bus that is moving at a constant velocity, you will land:
a. farther back in the bus b. farther front in the bus c. at the same place in the bus

Questions 23 & 24: A student in a school bus moving at a constant velocity drops his books

- ___ 23. A person next to him on the moving bus would see the books moving:
a. straight down
b. down in a diagonal path
c. in a parabolic path opposite to the direction of the motion of the bus
d. in a parabolic path in the direction of motion of the bus
- ___ 24. A person standing outside the bus would see the books moving:
a. straight down
b. down in a diagonal path
c. in a parabolic path opposite to the direction of the motion of the bus
d. in a parabolic path in the direction of motion of the bus

- ___ 25. Equilibrium occurs when:
- all the forces acting on an object are balanced
 - the sum of the upward forces is greater than the sum of the downward forces
 - the net force on an object is less than zero
 - all of the above
- ___ 26. What would be the safest way to put up a hammock?
- with the ropes as tight as possible
 - with some slack in the ropes
 - it does not make any difference the way the ropes are strung

- ___ 27. Two spring balances support a piece of iron as shown. The weight of the iron piece is 10.0 N. What is the reading of the balances?
- less than 5.0 N
 - 5.0 N
 - 7.0 N
 - 10.0 N
- ___ 28. If the spring balances in the diagram were moved farther apart, the reading of the spring scales would:
- increase
 - decrease
 - remain the same
- ___ 29. What is the approximate reading of each of the balances in the diagram to the right?
- 5 N
 - 10 N
 - 20 N

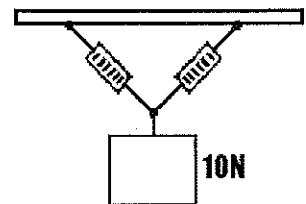


Questions/Problems – Be sure to show your work

30. Sometimes when you come to a sudden stop, the books on the seat beside you land on the floor of the car. Explain why.

31. When supporting an object from two points (see pic, below right),
- What angle will provide you with the same amount of tension on all sides?

b.) What do we call this angle?



32. Provide one other detailed example of Newton's 1st Law.