

# Chapter 4 Newton's Laws of Motion

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## 4.1 Questions About Newton's First and Second Law of Motion

- 1) Which has the greater mass?
- A) a king-size pillow
  - B) an automobile battery
  - C) neither — both have the same

Answer: B

Diff: 1

Topic: Newton's 1st Law

- 2) A kilogram is a measure of an object's
- A) weight.
  - B) force.
  - C) mass.
  - D) size.

Answer: C

Diff: 1

Topic: Newton's 1st Law

- 3) Compared to a 1-kg block of solid iron, a 2-kg block of solid iron has twice as much
- A) inertia.
  - B) mass.
  - C) volume.
  - D) all of these
  - E) none of these

Answer: D

Diff: 1

Topic: Newton's 1st Law

- 4) Compared to a 1-kg block of solid iron, a 2-kg block of solid iron has the same
- A) mass.
  - B) volume.
  - C) weight.
  - D) all of these
  - E) none of these

Answer: E

Diff: 1

Topic: Newton's 1st Law

- 10) A force is a vector quantity because it has both
- A) magnitude and direction.
  - B) mass and acceleration.
  - C) action and reaction counterparts.

Answer: A

Diff: 1

Topic: Newton's 2nd Law

- 11) A 10-kg brick and a 1-kg book are dropped in a vacuum. The force of gravity on the 10-kg brick is
- A) the same as the force on the 1-kg book.
  - B) 10 times as much
  - C) one-tenth as much.
  - D) zero.

Answer: B

Diff: 1

Topic: Newton's 2nd Law

- 12) An object is propelled along a straight-line path by a force. If the net force were doubled, the object's acceleration would be
- A) half as much.
  - B) the same.
  - C) twice as much.
  - D) four times as much.
  - E) none of these.

Answer: C

Diff: 1

Topic: Newton's 2nd Law

- 13) If an object's mass is decreasing while a constant force is applied to the object, the acceleration
- A) decreases.
  - B) increases.
  - C) remains the same.

Answer: B

Diff: 1

Topic: Newton's 2nd Law

- 14) The newton is a unit of
- A) force.
  - B) mass.
  - C) density.
  - D) inertia.

Answer: A

Diff: 1

Topic: Newton's 1st Law

- 20) A 10-N falling object encounters 4 N of air resistance. The net force on the object is
- A) 0 N.
  - B) 4 N.
  - C) 6 N.
  - D) 10 N.
  - E) none of these.

Answer: C

Diff: 1

Topic: Newton's 2nd Law

- 21) A 10-N falling object encounters 10 N of air resistance. The net force on the object is
- A) 0 N.
  - B) 4 N.
  - C) 6 N.
  - D) 10 N.
  - E) none of these

Answer: A

Diff: 1

Topic: Newton's 2nd Law

- 22) An apple weighs 1 N. When held at rest above your head, the net force on the apple is
- A) 0 N.
  - B) 0.1 N.
  - C) 1 N.
  - D) 9.8 N.
  - E) none of these

Answer: A

Diff: 1

Topic: Newton's 2nd Law

- 23) An apple at rest weighs 1 N. The net force on the apple when it is in free fall is
- A) 0 N.
  - B) 0.1 N.
  - C) 1 N.
  - D) 9.8 N.
  - E) none of these

Answer: C

Diff: 1

Topic: Newton's 2nd Law

- 24) Which has zero acceleration? An object
- A) at rest.
  - B) moving at constant velocity.
  - C) in mechanical equilibrium.
  - D) all of these
  - E) none of these

Answer: D

Diff: 1

Topic: Newton's 2nd Law

- 30) If a non-rotating object has no acceleration, then we can say for certain that it is
- A) at rest.
  - B) moving at constant non-zero velocity.
  - C) in mechanical equilibrium.
  - D) all of these
  - E) none of these

Answer: C

Diff: 2

Topic: Newton's 2nd Law

- 31) When you relax at rest with your left foot on one bathroom scale and your right foot on a similar scale, each of the scales will
- A) indicate exactly half your weight.
  - B) indicate part of your total weight but not necessarily half of it.
  - C) indicate different values that will equal your weight when added together.
  - D) Any of the above may be correct.

Answer: D

Diff: 2

Topic: Newton's 2nd Law

- 32) Hang from a pair of gym rings and the upward support forces of the rings will always
- A) each be half your weight.
  - B) each be equal to your weight.
  - C) add up to equal your weight.

Answer: C

Diff: 2

Topic: Newton's 2nd Law

- 33) A car has a mass of 1000 kg and accelerates at 2 meters per second per second. What is the magnitude of the net force exerted on the car?
- A) 500 N
  - B) 1000 N
  - C) 1500 N
  - D) 2000 N
  - E) none of these

Answer: D

Diff: 2

Topic: Newton's 2nd Law

- 34) A tow truck exerts a force of 3000 N on a car, accelerating it at 2 meters per second per second. What is the mass of the car?
- A) 500 kg
  - B) 1000 kg
  - C) 1500 kg
  - D) 3000 kg
  - E) none of these

Answer: C

Diff: 2

Topic: Newton's 2nd Law

- 40) The force required to maintain an object at a constant velocity in free space is equal to
- A) zero.
  - B) the mass of the object.
  - C) the weight of the object.
  - D) the force required to stop it.
  - E) none of these

Answer: A

Diff: 2

Topic: Newton's 2nd Law

- 41) An object following a straight-line path at constant speed
- A) has a net force acting upon it in the direction of motion.
  - B) has zero acceleration.
  - C) has no forces acting on it
  - D) none of these

Answer: B

Diff: 2

Topic: Newton's 2nd Law

- 42) A man weighing 800 N stands at rest on two bathroom scales so that his weight is distributed evenly over both scales. The reading on each scale is
- A) 200 N.
  - B) 400 N.
  - C) 800 N.
  - D) 1600 N.
  - E) none of these

Answer: B

Diff: 1

Topic: Newton's 2nd Law

- 43) Neglecting friction, a large block of ice and a small block of ice start sliding down an incline together. The heavier block will get to the bottom
- A) before the light block.
  - B) after the light block.
  - C) at the same time as the light block.

Answer: C

Diff: 1

Topic: Newton's 2nd Law

- 44) When a woman stands at rest with both feet on a scale, it reads 500 N. When she gently lifts one foot, the scale reads
- A) less than 500 N.
  - B) more than 500 N.
  - C) 500 N.

Answer: C

Diff: 1

Topic: Newton's 2nd Law

- 50) A block is dragged without acceleration in a straight-line path across a level surface by a force of 6 N. What is the force of friction between the block and the surface?
- A) less than 6 N
  - B) more than 6 N
  - C) 6 N
  - D) need more information to say

Answer: C

Diff: 2

Topic: Newton's 2nd Law

- 51) Suppose a particle is being accelerated through space by a 10-N force. Suddenly the particle encounters a second force of 10 N in the opposite direction from the first force. The particle with both forces acting on it
- A) is brought to a rapid halt.
  - B) decelerates gradually to a halt.
  - C) continues at the speed it had when it encountered the second force.
  - D) theoretically tends to accelerate toward the speed of light.
  - E) none of these

Answer: C

Diff: 2

Topic: Newton's 2nd Law

- 52) A jumbo jet has a mass of 100,000 kg. The thrust for each of its four engines is 50,000 N. What is the jet's acceleration in meters per second per second when taking off?
- A) 0.25
  - B) 1
  - C) 2
  - D) 4
  - E) none of these

Answer: C

Diff: 2

Topic: Newton's 2nd Law

- 53) A 1-kg rock that weighs 9.8 N is thrown straight upward at 20 m/s. Neglecting air resistance, the net force that acts on it when it is half way to the top of its path is
- A) less than 9.8 N.
  - B) 9.8 N.
  - C) more than 9.8 N.

Answer: B

Diff: 2

Topic: Newton's 2nd Law

- 58) A car traveling at 22 m/s comes to an abrupt halt in 0.1 second when it hits a tree. What is the deceleration in meters per second per second of the car?
- A) 110
  - B) 220
  - C) 800
  - D) 880
  - E) can't be solved without the mass of the car

Answer: B

Diff: 3

Topic: Newton's 2nd Law

- 59) A 10-kilogram block with an initial velocity of 10 m/s slides 10 meters across a horizontal surface and comes to rest. It takes the block 2 seconds to stop. The stopping force acting on the block is about
- A) 5 N.
  - B) 10 N.
  - C) 25 N.
  - D) 50 N.
  - E) none of these

Answer: D

Diff: 3

Topic: Newton's 2nd Law

- 60) A 10-kilogram block is pushed across a horizontal surface with a horizontal force of 20 N against a friction force of 10 N. The acceleration of the block in meters per second per second is
- A) 1.
  - B) 2.
  - C) 5.
  - D) 10.
  - E) none of these

Answer: A

Diff: 3

Topic: Newton's 2nd Law

- 61) If you are driving at 20 m/s and slam on your brakes and skid at 0.5 g to a full stop, the skidding time in seconds is
- A) about 3.
  - B) about 4.
  - C) about 5.
  - D) about 6.
  - E) more than 6.

Answer: B

Diff: 3

Topic: Newton's 2nd Law

- 66) The human body can, under certain conditions, withstand an acceleration of 10 g. What net force would produce this acceleration of a 50-kg person?
- A) about 500 N
  - B) about 2500 N
  - C) about 5000 N
  - D) about 25,000 N
  - E) none of these

Answer: C

Diff: 3

Topic: Newton's 2nd Law

- 67) If an object of constant mass experiences a constant net force, it will have a constant
- A) velocity.
  - B) speed.
  - C) acceleration.
  - D) position.
  - E) more than one of the above

Answer: C

Diff: 1

Topic: Newton's 2nd Law

- 68) If more horizontal force is applied to a sliding object than is needed to maintain a constant velocity,
- A) the object accelerates in the direction of the applied force.
  - B) the object accelerates opposite the direction of the applied force.
  - C) the friction force increases.
  - D) two of the above
  - E) none of the above

Answer: A

Diff: 2

Topic: Newton's 2nd Law

- 69) If less horizontal force is applied to a sliding object than is needed to maintain a constant velocity,
- A) the object accelerates in the direction of the applied force.
  - B) the friction force increases.
  - C) the object eventually slides to a stop.
  - D) none of the above

Answer: C

Diff: 2

Topic: Newton's 2nd Law

## 4.2 Questions About Falling

- 1) Two factors that greatly affect air resistance on falling objects are the
- A) size and mass of the object.
  - B) size and weight of the object.
  - C) size and speed of the object.

Answer: C

Diff: 1

Topic: Falling



- 7) A sack of potatoes weighing 200 N falls from an airplane. As the velocity of fall increases, air resistance also increases. When air resistance equals 200 N, the sack's acceleration in meters per second per second is
- A) 0.
  - B) 4.9.
  - C) 9.8.
  - D) infinite.
  - E) none of these

Answer: A

Diff: 1

Topic: Falling

- 8) An coconut and a feather fall from a tree through the air to the ground below. The amount of air-resistance force is
- A) greater on the coconut.
  - B) greater on the feather.
  - C) the same on each.

Answer: A

Diff: 2

Topic: Falling

- 9) A lightweight feather slides off a table and falls through the air until it reaches the floor. During the time of its fall, its acceleration
- A) keeps increasing.
  - B) keeps decreasing.
  - C) never changes.
  - D) is sometimes zero.

Answer: D

Diff: 2

Topic: Falling

- 10) A skydiver jumps from a high-flying plane. As her velocity of fall increases, her acceleration
- A) increases.
  - B) decreases.
  - C) remains unchanged regardless of air resistance.

Answer: B

Diff: 2

Topic: Falling

- 11) A skydiver steps from a helicopter and falls for a few seconds until he reaches his terminal velocity. Thereafter, until he opens his parachute, his acceleration
- A) is constant.
  - B) increases.
  - C) decreases.
  - D) is zero.
  - E) none of these

Answer: D

Diff: 2

Topic: Falling

- 17) A ball thrown straight upward takes 10 seconds to go up and return to the ground. Because of air resistance, the time taken for the ball just to go up is
- A) less than 5 s.
  - B) more than 5 s.
  - C) 5 s.

Answer: A

Diff: 3

Topic: Falling

- 18) A falling skydiver of mass 100 kg experiences 500 N air resistance. The acceleration of the skydiver is
- A) 0.2 g.
  - B) 0.3 g.
  - C) 0.4 g.
  - D) 0.5 g.
  - E) more than 0.5 g.

Answer: D

Diff: 3

Topic: Falling

- 19) An astronaut on another planet drops a 1-kg rock from rest. The astronaut notices that the rock falls 2 meters straight down in one second. On this planet, how much does the rock weigh?
- A) 1 N
  - B) 4 N
  - C) 4.9 N
  - D) 5 N

Answer: B

Diff: 3

Topic: Falling

- 20) A feather and a coin will have equal accelerations when falling in a vacuum because
- A) their velocities are the same.
  - B) the force of gravity is the same for each in a vacuum.
  - C) the force of gravity does not act in a vacuum.
  - D) the ratio of each object's weight to its mass is the same.
  - E) none of these.

Answer: D

Diff: 3

Topic: Falling

- 21) A skydiver's terminal velocity will be greatest if she falls
- A) head first.
  - B) lying flat on her back.
  - C) lying flat on her stomach.
  - D) with her parachute open.

Answer: A

Diff: 3

Topic: Falling

Figure 4-A



- 9) Arnold Strongman and Suzie Small each pull very hard on opposite ends of a massless rope in a tug-of-war. The greater force on the rope is exerted by
- Arnold, of course.
  - Suzie, surprisingly.
  - both the same, interestingly enough.

Answer: C

Diff: 1

Topic: Newton's 3rd Law

- 10) The Earth pulls on the moon. Similarly the moon pulls on the Earth, evidence that
- these two pulls comprise an action-reaction pair.
  - the earth is larger so its pull is larger.
  - the moon is smaller so its pull is smaller.
  - larger objects pull harder.

Answer: A

Diff: 1

Topic: Newton's 3rd Law

- 11) The attraction of a person's body toward the Earth is called weight. The reaction to this force is
- the person's body pushing against the Earth's surface.
  - the Earth's surface pushing against the person's body.
  - the person's body pulling on the Earth.
  - none of these.

Answer: C

Diff: 2

Topic: Newton's 3rd Law

- 12) A skydiver falls towards the Earth. The attraction of the Earth on the diver pulls the diver down. What is the reaction to this force?
- air resistance the diver encounters while falling
  - water resistance that will soon act upward on the diver
  - the attraction to the planets, stars, and every particle in the universe
  - all of these
  - none of these

Answer: E

Diff: 2

Topic: Newton's 3rd Law

- 13) A automobile and a baby carriage traveling at the same speed collide head -on. The impact force is
- A) greater on the automobile.
  - B) greater on the baby carriage.
  - C) the same for both.

Answer: C

Diff: 2

Topic: Newton's 3rd Law

- 14) A Mack truck and a Volkswagen traveling at the same speed have a head -on collision. The vehicle that undergoes the greatest change in velocity will be the
- A) Volkswagen.
  - B) Mack truck.
  - C) same for both.

Answer: A

Diff: 2

Topic: Newton's 3rd Law

- 15) A 10.0 N force is pulling up on the ring of spring scale that weighs 2.0 N. If an 8.0 N mass is attached to the bottom hook of the scale, the scale reading would be
- A) 0 N.
  - B) 2.0 N.
  - C) 8.0 N.
  - D) 10.0 N
  - E) 12.0 N

Answer: C

Diff: 3

Topic: Newton's 3rd Law

- 16) A car traveling at 100 km/hr strikes an unfortunate bug and splatters it. The force of impact is
- A) greater on the bug.
  - B) greater on the car.
  - C) the same for both.

Answer: C

Diff: 2

Topic: Newton's 3rd Law

- 17) The force exerted by the road on each tire of an accelerating car
- A) equals the combined force of all four tires on the road.
  - B) is less than the combined force of all four tires on the road.
  - C) is more than the combined force on all four tires on the road.

Answer: B

Diff: 2

Topic: Newton's 3rd Law