

Conceptual Physics Semester One Exam

Multiple-Choice Questions: *Circle* the best answer!!!

- 1) The earliest and most influential Greek philosopher was Aristotle, who among many contributions taught that
 - A) the four elements are earth, water, air, and fire.
 - B) all motion is either natural or violent.
 - C) violent motion requires a sustained push or pull.
 - D) all of the above

- 3) The first scientist to be credited for postulating that Earth circled the Sun was
 - A) Aristotle.
 - B) Copernicus.
 - C) Galileo.
 - D) Newton.

- 4) The first scientist to introduce the concept of inertia was
 - A) Aristotle.
 - B) Galileo.
 - C) Newton.
 - D) Copernicus.

- 5) Inertia is defined as a
 - A) force.
 - B) property of matter.
 - C) change in motion.
 - D) none of the above

- 6) If no external forces act on a moving object, it will
 - A) continue moving at the same velocity.
 - B) move slower and slower until it finally stops.
 - C) come to an abrupt halt.
 - D) none of the above

- 7) Galileo taught us that if you roll a ball along a level surface it will
 - A) soon slow down due to its natural place.
 - B) keep rolling if friction is absent.
 - C) roll as long as its inertia nudges it along.
 - D) soon roll in the opposite direction.

- 8) A hockey puck sliding across the ice finally comes to rest because
 - A) it seeks its proper and natural state.
 - B) of friction.
 - C) that's just the way it is.

- 9) A hockey puck is set in motion across a frozen pond. If ice friction and air resistance are neglected, the force required to keep the puck sliding at constant velocity is
- A) equal to its weight.
 - B) equal to its weight divided by its mass.
 - C) equal to its mass times its weight.
 - D) none of the above

- 10) The amount of force needed to sustain motion of a rock in outer space is
- A) a force equal to its weight.
 - B) a force less than its weight if friction is absent.
 - C) none of these

Answer: C

Diff: 1

Topic: Newton's First Law

- 11) When no forces act on moving objects their paths are normally
- A) straight lines.
 - B) circles.
 - C) ellipses.
 - D) all of the above

- 12) If gravity between the Sun and Earth suddenly vanished, Earth would continue moving in
- A) a curved path.
 - B) an outward spiral path.
 - C) an inward spiral path.
 - D) a straight-line path.

- 13) Whirl a rock at the end of a string and it follows a circular path. If the string breaks, the tendency of the rock is to
- A) follow a circular path.
 - B) slow down.
 - C) follow a straight-line path.
 - D) stop.

- 14) Which concept is being illustrated when a tablecloth is quickly yanked beneath dishes resting on a table?
- A) equilibrium
 - B) friction
 - C) support force
 - D) inertia

- 15) A roller-coaster ride with 6 passengers takes 3 minutes. Neglecting friction, a similar ride with 12 passengers aboard would take
- A) 1.5 minutes.
 - B) 3 minutes.
 - C) 6 minutes.
 - D) 18 minutes.
- 16) A package falls off a truck that is moving at 30 m/s. Neglecting air resistance, the horizontal speed of the package just before it hits the ground is
- A) zero.
 - B) less than 30 m/s but more than zero.
 - C) about 30 m/s.
 - D) more than 30 m/s.
- 17) When a rocket ship gaining speed in outer space runs out of fuel, it
- A) gains speed for a short time, then slows down to a constant velocity.
 - B) gains speed for a short time, slows down, and eventually stops.
 - C) no longer gains speed.
- 18) While you are standing in the aisle of a bus, the driver suddenly makes a left turn. You lurch to the right due to
- A) an unbalanced force.
 - B) your tendency to keep moving forward.
 - C) an equilibrium challenge.
- 19) When you quickly jerk a cart forward that has a ball resting in the middle, the
- A) front of the cart hits the ball.
 - B) back of the cart hits the ball.
 - C) neither, for the ball rides along in the middle as the cart moves forward.
 - D) All of the above depending on how quickly the cart is pulled.
- 20) A force is a vector quantity because it has both
- A) magnitude and direction.
 - B) mass and velocity.
 - C) action and reaction counterparts.
 - D) speed and direction.

- 21) A block pulled to the left with 15 N and to the right with 5 N at the same time experiences a net force of
- A) 5 N.
 - B) 10 N.
 - C) 15 N.
 - D) 20 N.
- 22) A tree stump is pulled northward by a 10-N force at the same time a 25-N force pulls it southward. The resultant force has a magnitude of
- A) 0 N.
 - B) 15 N.
 - C) 25 N.
 - D) 150 N.
- 23) A pair of 10-N vectors at right angles to each other has a resultant of about
- A) 10 N.
 - B) 14 N.
 - C) 20 N.
 - D) none of the above
- 24) When Nellie Newton hangs by the ends of a rope draped over a large pulley, the tension in each supporting vertical strand is
- A) half her weight.
 - B) equal to her weight.
 - C) twice her weight.
 - D) none of the above
- 25) Suspend your body from a pair of ropes slightly angled from the vertical and the tension in each rope will be
- A) equal your weight.
 - B) half your weight.
 - C) greater than half your weight.
 - D) none of these
- 26) The net force on any object in equilibrium is
- A) zero.
 - B) equal to its weight.
 - C) less than its weight.
 - D) non-zero when motion is involved.

27) The equilibrium rule, $\Sigma F = 0$, applies to

- A) objects or systems at rest.
- B) objects or systems in uniform motion in a straight line.
- C) both of these
- D) neither of these

28) An object in mechanical equilibrium is an object

- A) moving with constant velocity.
- B) having no changes in velocity.
- C) at rest.
- D) all of the above

29) When Burl and Paul stand on opposite ends of a sign-painting scaffold, the tensions in the supporting ropes

- A) are equal.
- B) depend on the relative weights of Burl and Paul.
- C) combine to equal zero.
- D) are in equilibrium.

30) Burl and Paul have a total weight of 1300 N. The tensions in the supporting ropes that support their scaffold add to 1700 N. The weight of the scaffold itself must be

- A) 300 N.
- B) 400 N.
- C) 500 N.
- D) 600 N.

31) A hockey puck sliding at constant velocity across the ice is

- A) in equilibrium.
- B) nearly in equilibrium.
- C) is nowhere near being in equilibrium.
- D) none of the above

32) The net force acting on an insect falling downward at constant velocity is

- A) zero.
- B) the weight of the insect.
- C) upward air resistance.
- D) none of the above

33) The minimum number of forces that act on a book resting on a table is

- A) 1.
- B) 2.
- C) 3.
- D) 4.
- E) none of the above

- 34) The support force on a 10-N book at rest on a table is
- A) slightly less than 10 N.
 - B) 10 N.
 - C) slightly greater than 10 N.
 - D) dependent on the position of the book.
- 35) Weigh yourself on a weighing scale and the scale shows your normal weight. If you carefully stand on tiptoes, the scale reading will be
- A) slightly more.
 - B) slightly less.
 - C) about half as much.
 - D) no different.
- 36) The force that causes Earth to orbit the Sun is due to gravity, while the force needed to keep Earth moving as it circles the Sun is
- A) inertia.
 - B) due to gravity.
 - C) due to both inertia and gravity.
 - D) no force at all.
- 37) If you toss a coin straight upward while in a train moving at constant velocity, the coin will land
- A) as if you were at rest.
 - B) in front of you.
 - C) in back of you.
- 38) If you toss a coin straight upward in train that slows while the coin is in the air, the coin will land
- A) as if you were at rest.
 - B) in front of you.
 - C) in back of you.
- 40) The tendency of a rolling ball is to continue rolling—in the absence of a force. The fact that it slows down is likely due to the force of _____.
- 41) Copernicus and others of his day thought an enormous force would have to continuously push the Earth to keep it in motion. He was unfamiliar with the concept of _____ and didn't realize that once a body is in motion, no force is needed to keep it moving (assuming no friction).

42) _____ are the metric unit of force.

43) _____ is the metric unit of mass.

44) "Σ" (sigma) means _____.

45) Inertia is a _____ of matter.

1) Katelyn runs along the aisle of a train that moves at 8 m/s. Her speed relative to the floor is 3 m/s. Her speed relative to an observer at rest on the ground is

A) 5 m/s.

B) 11 m/s.

C) either depending on her running direction

D) none of the above

2) You're at rest in a hammock when a hungry mosquito sees an opportunity for lunch. A mild 2-m/s breeze is blowing. If the mosquito joins you for lunch it should hover over you by flying

A) against the breeze at 2 m/s.

B) with the breeze at 2 m/s.

C) a bit faster than wind speed.

D) none of the above

3) Jogging Jake runs at 4 m/s along a train flatcar that moves at 10 m/s in the same direction. Jake's speed relative to the ground is

A) 6 m/s.

B) 10 m/s.

C) 14 m/s.

D) none of the above

4) Jogging Jake runs at 4 m/s along a train flatcar that moves at 10 m/s in the opposite direction. Jake's speed relative to the ground is

A) 6 m/s.

B) 10 m/s.

C) 14 m/s.

D) none of the above

5) The speedometer of an automobile reads

A) average speed.

B) instantaneous speed.

C) accelerated speed.

6) The two measurements necessary for calculating average speed are

A) acceleration and time.

B) velocity and time.

C) distance and time.

D) distance and acceleration.

E) velocity and distance.

- 7) When you walk at an average speed of 4 m/s, in 5 s you'll cover a distance of
- A) 2 m.
 - B) 10 m.
 - C) 15 m.
 - D) 20 m.
- 8) A vehicle undergoes acceleration when it
- A) gains speed.
 - B) loses speed.
 - C) changes its direction.
 - D) all of the above
- 9) The average speed of a horse that gallops 10 kilometers in 30 minutes is
- A) 15 km/h.
 - B) 20 km/h.
 - C) 30 km/h.
 - D) 40 km/h.
- 10) While a car travels around a circular track at a constant speed, its
- A) acceleration is zero.
 - B) velocity is zero.
 - C) inertia is zero.
 - D) none of the above
- 11) If a car increases its velocity from zero to 60 m/s in 10 seconds, its acceleration is
- A) 3 m/s^2 .
 - B) 6 m/s^2 .
 - C) 60 m/s^2 .
 - D) 600 m/s^2 .
- 12) A cart maintains a constant velocity of 100 m/s for 10 seconds. During this interval its acceleration is
- A) zero.
 - B) 1 m/s^2 .
 - C) 10 m/s^2 .
 - D) none of the above
- 13) A cart changes its speed from 90 m/s to 100 m/s in 10 seconds. During this interval its acceleration is
- A) zero.
 - B) 1 m/s^2 .
 - C) 10 m/s^2 .
 - D) none of the above
- 14) If an object moves with constant acceleration, its velocity must
- A) be constant also.
 - B) change by the same amount each second.
 - C) change by varying amounts depending on its speed.
 - D) always decrease.

- 15) A rock dropped from a 5-m height accelerates at 10 m/s^2 and strikes the ground 1 s later. If the rock is dropped from a height of 2.5 m, its *acceleration* of fall is
- A) half.
 - B) the same.
 - C) twice.
 - D) four times as much.
- 16) A car's speed 3 seconds after accelerating from rest at 2 m/s^2 is
- A) 2 m/s.
 - B) 3 m/s.
 - C) 4 m/s.
 - D) 6 m/s.
- 17) The time it takes a car to attain a speed of 30 m/s when accelerating from rest at 2 m/s^2 is
- A) 2 s.
 - B) 15 s.
 - C) 30 s.
 - D) 60 s.
 - E) none of the above
- 18) What is the acceleration of a car that starts from rest and 5 seconds later reaches a speed of 20 m/s?
- A) 1 m/s^2
 - B) 2 m/s^2
 - C) 3 m/s^2
 - D) 4 m/s^2
 - E) 5 m/s^2
- 19) Ten seconds after starting from rest, a car is moving at 40 m/s. What is the car's acceleration?
- A) 0.25 m/s^2
 - B) 2.8 m/s^2
 - C) 4.0 m/s^2
 - D) 10 m/s^2
 - E) 40 m/s^2
- 20) A freely-falling watermelon falls with constant
- A) velocity.
 - B) speed.
 - C) acceleration.
 - D) distances each successive second.
- 21) The distance a freely falling bowling ball falls each second
- A) is about 5 m.
 - B) is about 10 m.
 - C) increases.
 - D) none of the above

- 22) If a stone falls to the bottom of a mineshaft in 6 seconds, then the depth of the shaft is about
- A) 60 m.
 - B) 120 m.
 - C) 180 m.
 - D) more than 200 m.
- 23) If a freely falling object were equipped with a speedometer, its speed reading would increase each second by about
- A) 5 m/s.
 - B) 10 m/s.
 - C) 15 m/s.
 - D) a variable amount.
 - E) depends on its initial speed
- 24) If an object falling freely were somehow equipped with an odometer to measure the distance it travels, then the amount of distance it travels each succeeding second would be
- A) constant.
 - B) less and less each second.
 - C) greater than the second before.
 - D) doubled.
- 25) A ball is thrown upwards and returns to the same location. Compared with its initial speed its speed when it returns is about
- A) half as much.
 - B) the same.
 - C) twice as much.
 - D) four times as much.
- 26) At one instant an object in free fall is moving downward at 50 m/s. One second later its speed is
- A) 25 m/s.
 - B) 50 m/s.
 - C) 55 m/s.
 - D) 60 m/s.
 - E) 100 m/s.
- 27) If you throw a ball straight downward (in the absence of air resistance), after leaving your hand its acceleration is
- A) less than 10 m/s^2 .
 - B) 10 m/s^2 .
 - C) greater than 10 m/s^2 .
- 28) The time it takes a projectile fired straight up at 10 m/s to reach the top of its path is about
- A) 1 s.
 - B) 2 s.
 - C) 10 s.
 - D) not enough information

- 29) The total time it takes a projectile fired straight up at 10 m/s to reach the top of its path and return to its starting point is about
- A) 1 s.
 - B) 2 s.
 - C) 10 s.
 - D) 20 s.
- 30) Neglecting air resistance, a bullet fired straight down from the top of a high cliff has an acceleration of
- A) less than 10 m/s^2 .
 - B) 10 m/s^2 .
 - C) more than 10 m/s^2 .
 - D) depends on the height of the cliff.
- 31) A bullet is dropped into a river from a very high bridge at the same time as another bullet is fired straight downward from a rifle. Neglecting air resistance, the acceleration just before striking the water is
- A) greater for the dropped bullet.
 - B) greater for the fired bullet.
 - C) the same for each bullet.
 - D) none of the above
- 32) As water drops fall at a steady rate from a leaking faucet they
- A) get closer together.
 - B) get farther apart.
 - C) remain at a relatively fixed distance from one another.
- 33) Which of the following is not a vector quantity?
- A) velocity
 - B) speed
 - C) acceleration
 - D) all are vector quantities
 - E) none are vector quantities.
- 34) An 80-km/h airplane flying in the same direction as a 10 km/h tail wind has a groundspeed of
- A) 10 km/h.
 - B) 70 km/h.
 - C) 80 km/h.
 - D) 90 km/h.
- 35) An 80-km/h airplane flying against a 10-km/h head wind has a groundspeed of
- A) 10 km/h.
 - B) 70 km/h.
 - C) 80 km/h.
 - D) 90 km/h.

Chapter 4 Newton's Second Law of Motion

1) Whenever the net force on an object is zero, its acceleration

- A) may be less than zero.
- B) is zero.
- C) may be more than zero.

2) If an apple 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

3) If you double the net force on an object, you'll double its

- A) acceleration.
- B) speed.
- C) velocity.
- D) all the above

4) If the net force on a cart is tripled, the cart's acceleration

- A) is one third.
- B) is two thirds.
- C) is three times as much.
- D) is more than three times as much.

5) A mobile phone is pulled northward by a force of 10 N and at the same time pulled southward by another force of 15 N. The resultant force on the phone is

- A) 0 N.
- B) 5 N.
- C) 25 N.
- D) 150 N.

6) The force of friction on a sliding object is 10 N. The applied force needed to maintain a constant velocity is

- A) more than 10 N.
- B) less than 10 N.
- C) 10 N.

7) 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 the above

8) 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.

- 9) A 300-kg bear grasping a vertical tree slides down at constant velocity. The friction force between the tree and the bear is
- A) 30 N.
 - B) 300 N.
 - C) 3000 N.
 - D) more than 3000 N.
- 10) The newton is a unit of
- A) force.
 - B) mass.
 - C) density.
 - D) inertia.
- 11) An object's weight is properly expressed in units of
- A) meters.
 - B) kilograms.
 - C) newtons.
 - D) cubic centimeters.
- 12) A 1-kg mass at the Earth's surface weighs
- A) 1 N.
 - B) 5 N.
 - C) 10 N.
 - D) 12 N.
 - E) none of the above
- 13) A kilogram is a measure of an object's
- A) force.
 - B) mass.
 - C) both of these
 - D) neither of these
- 14) The mass of a pet turtle that weighs 10 N is about
- A) 1 kg.
 - B) 10 kg.
 - C) 100 kg.
 - D) 1000 kg.
 - E) none of the above
- 15) A bag of groceries that has a mass of 10 kilograms weighs about
- A) 1 N.
 - B) 10 N.
 - C) 100 N.
 - D) 1000 N.
 - E) greater than 1000 N.

16) Compared to the mass of an apple on Earth, the mass of the apple on the Moon is

- A) one sixth as much.
- B) the same.
- C) six times as much.
- D) zero.

17) Your weight as measured on your bathroom scale is

- A) equal to your mass.
- B) the force due to gravity on you.
- C) a property of mechanical equilibrium.
- D) all of the above

18) An object with twice as much mass as another object has twice as much

- A) inertia.
- B) speed.
- C) acceleration due to gravity.
- D) all of the above

19) Strange as it may seem, it is just as difficult to accelerate a car on a level surface on the Moon as it is here on Earth because

- A) the mass of the car is independent of gravity.
- B) the weight of the car is independent of gravity.
- C) both of these
- D) neither of these

20) At equilibrium on a bathroom weighting scale, the downward pull of gravity on you is balanced by

- A) your weight.
- B) an upward support force.
- C) your mass.

21) A heavy ball hangs by a string, with a second string attached to its bottom (Figure 4.8 in your book). A quick pull on the bottom string breaks the

- A) top string.
- B) bottom string.
- C) top or bottom string equally.

22) A heavy ball hangs by a string, with a second string attached to its bottom. A slow pull on the bottom string breaks the

- A) top string.
- B) bottom string.
- C) top or bottom string equally.

23) A constant net force on a rail-road car produces constant

- A) velocity.
- B) acceleration.
- C) both of these
- D) neither of these

24) An apple weighs 1 N. When the apple is 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 the above

25) 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 the above

26) Which has zero acceleration? An object

- A) at rest.
- B) moving at constant velocity.
- C) in mechanical equilibrium.
- D) all of the above
- E) none of the above

27) You drive your car at a constant 60 km/h along the highway. You apply the brakes until the car slows to 40 km/h. If at that moment you suddenly release the brakes, the car tends to

- A) momentarily regain its higher initial speed.
- B) continue moving at 40 km/h.
- C) decrease in speed if no other forces act.

28) A heavy block at rest is suspended by a vertical rope. When the block accelerates upward by the rope, the rope tension

- A) is less than its weight.
- B) equals its weight.
- C) is greater than its weight.

29) A car has a mass of 1000 kg and accelerates at 2 m/s^2 . What net force is exerted on the car?

- A) 500 N
- B) 1000 N
- C) 1500 N
- D) 2000 N
- E) none of these

30) A tow truck exerts a force of 3000 N on a car, which then accelerates at 2 m/s^2 . What is the mass of the car?

- A) 500 kg
- B) 1000 kg
- C) 1500 kg
- D) 3000 kg
- E) none of these

- 31) A force of 1 N accelerates 1-kg box at the rate of 1 m/s^2 . The acceleration of a 2-kg box by a net force of 2 N is
- A) half as much.
 - B) twice as much.
 - C) the same.
 - D) none of the above
- 32) The force required to maintain a constant velocity for an astronaut in free space is equal to
- A) zero.
 - B) the mass of the astronaut.
 - C) the weight of the astronaut.
 - D) the force required to stop the astronaut.
 - E) none of the above
- 33) A boulder following a straight-line path at constant velocity has
- A) a net force acting upon it in the direction of motion.
 - B) zero acceleration.
 - C) no forces acting on it.
 - D) none of the above
- 34) Neglecting friction, a small and a large block of ice begin sliding down an incline together. The larger block reaches the bottom
- A) before the small block.
 - B) after the small block.
 - C) at the same time as the small block.
- 35) A 10-N block and a 1-N block lie on a horizontal frictionless table. To impart equal horizontal accelerations, we would have to push the heavier block with
- A) an equal force.
 - B) 10 times as much force.
 - C) 10 squared or 100 times as much force.
 - D) 1/10 as much force.
 - E) none of the above
- 36) A rock is thrown vertically into the air. At the top of its path the net force on it is
- A) less than mg .
 - B) mg .
 - C) more than mg .
- 37) A rock is thrown vertically into the air. At the top of its path, its acceleration is
- A) zero.
 - B) 10 m/s^2 .
 - C) between 0 and 10 m/s^2 .
 - D) greater than 10 m/s^2 .

- 38) A 1-kg ball is thrown at 10 m/s straight upward. Neglecting air resistance, the net force that acts on the stone when it is halfway to the top of its path is about
- A) 1/2 N.
 - B) 1 N.
 - C) 5 N.
 - D) 7.5 N.
 - E) 10 N.
- 39) 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 is
- A) 1 m/s².
 - B) 2 m/s².
 - C) 5 m/s².
 - D) 10 m/s².
 - E) none of the above
- 40) A 10-kg brick and a 1-kg apple are dropped in a vacuum. The force of gravity on the brick is
- A) the same as the force on the apple.
 - B) 10 times more than the force on the apple.
 - C) one-tenth as much as on the apple.
 - D) zero.
- 41) Recall Galileo's Leaning Tower experiment. With negligible air resistance, a heavy and a light object fall
- A) with equal accelerations.
 - B) with the same increases in speed.
 - C) to the ground in equal times.
 - D) all of the above
- 42) A bowling ball and a baseball accelerate equally when falling in a vacuum because
- A) their velocities are the same.
 - B) the ratio of their weights to mass is the same.
 - C) the force of gravity is the same for each in a vacuum.
 - D) the force of gravity does not act in a vacuum.
 - E) none of the above
- 43) When a falling object has reached its terminal velocity, its acceleration is
- A) zero.
 - B) g .
 - C) constant.
- 44) A light woman and a heavy man jump from an airplane at the same time and open their same-size parachutes at the same time. Which person will get to the ground first?
- A) The light woman
 - B) The heavy man
 - C) Both should arrive at the same time.
 - D) not enough information

- 45) Suzie Skydiver, who weighs 500 N, reaches terminal velocity of 90 km/h. The air resistance on Suzie is then
- A) 90 N.
 - B) 250 N.
 - C) 410 N.
 - D) 500 N.
 - E) none of the above
- 46) 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 becomes
- A) 0 m/s^2 .
 - B) 5 m/s^2 .
 - C) 10 m/s^2 .
 - D) infinite.
 - E) none of the above
- 47) A ball thrown straight upward takes 10 seconds for its up-and-down round trip. Because of air resistance, the time taken for the ball just to go up is
- A) less than 5 s.
 - B) 5 s.
 - C) more than 5 s.
- 48) 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.
- 49) Write out the 1st Law of Motion.
- 50) The formula for the 2nd Law of Motion is _____.
- 51) Write out the 3rd Law of Motion.
- 51) Acceleration due to gravity is _____.
- 52) Draw the forces present for a sky diver falling at terminal velocity.

Conceptual Physics, 12e (Hewitt)

Chapter 5 Newton's Third Law of Motion: Action and Reaction

5.1 Multiple-Choice Questions

1) To say there is no such thing as only one force means

- A) there must also be a corresponding reaction force.
- B) other forces, perhaps not evident, are there.
- C) gibberish.

2) You cannot exert a force on a wall

- A) if the wall resists.
- B) unless you put your mind to it.
- C) unless the wall simultaneously exerts the same amount of force on you.

3) When you rub your hands together, you

- A) can push harder on one hand than the other.
- B) cannot push harder on one hand than the other.
- C) need more information

4) When you drop a rubber ball on the floor it bounces back. The force exerted on the ball to produce bouncing is by the

- A) ball.
- B) floor.
- C) need more information

6) When a boxer hits a punching bag, the strength of his punch depends on how much force the bag can

- A) endure.
- B) exert on the boxer's fist.
- C) soften.

7) Your friend says that the heavyweight champion of the world cannot exert a force of 50 N on an isolated piece of tissue paper with his best punch. You

- A) agree that it can't be done.
- B) have reservations about this assertion.
- C) disagree, for a good punch easily delivers this much force.

10) The winner in a tug-of-war exerts the greatest force on

- A) the opponent.
- B) his or her end of the rope.
- C) the ground.

15) When you walk, you push on the floor to the left and the floor

- A) also pushes on you to the left.
- B) pushes you to the right.
- C) both of these simultaneously.
- D) can only wish it could push on you.
- E) none of the above

18) For every action force, there must be a reaction force that

- A) acts in the same direction.

- B) is slightly smaller in magnitude than the action force.
- C) is slightly larger in magnitude than the action force.
- D) is equal in magnitude.

19) An archer shoots an arrow. Consider the action force to be the bowstring against the arrow. The reaction to this force is the

- A) combined weight of the arrow and bowstring.
- B) friction of the ground against the archer's feet.
- C) grip of the archer's hand on the bow.
- D) arrow's push against the bowstring.

20) When a karate chop breaks a board with a 3000-N blow, the amount of force that acts on the hand is

- A) zero.
- B) 1500 N.
- C) 3000 N.
- D) 6000 N.

24) The lift experienced by a helicopter involves an action-reaction pair of forces between the

- A) helicopter blades and the air.
- B) mass of the helicopter and Earth's mass.
- C) weight of the helicopter and atmospheric pressure.
- D) motion of the helicopter relative to the ground below.
- E) any or all of the above

25) A player catches a ball. If action is the force of the ball against the player's glove, reaction is the

- A) player's grip on the glove.
- B) glove against the ball.
- C) friction of the ground against the player's shoes.
- D) muscular effort in the player's arms.
- E) none of the above

26) A player hits a ball with a bat. If action is the force of the bat against the ball, reaction is the

- A) air resistance on the ball.
- B) weight of the ball.
- C) force that the ball exerts on the bat.
- D) grip of the player's hand against the ball.
- E) weight of the bat.

29) The force exerted on the tires of a car that directly accelerate it along a road is exerted by the

- A) engine.
- B) tires.
- C) air.
- D) road.
- E) none of the above

30) Neglecting air resistance, once a tossed ball leaves your hand

- A) no further forces act on it.
- B) only the force due to gravity acts on it.
- C) inertia becomes the force acting on it.
- D) your tossing force remains while the ball goes upward.
- E) your tossing force remains until it comes to a stop.

32) An automobile and a golf cart traveling at the same speed collide head-on. The impact force is

- A) greater on the automobile.
- B) greater on the golf cart.
- C) the same for both.

33) 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.

35) A car traveling at 100 km/h 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.

36) When a tennis racquet hits a ball,

- A) the racquet loses as much speed as the ball gains.
- B) the ball is set in motion with the same speed of the racquet upon contact.
- C) the ball hits the racquet.
- D) all of the above

37) As a ball falls, the action force is the Earth's pull on the ball. The reaction force is the

- A) air resistance acting against the ball.
- B) acceleration of the ball.
- C) ball's pull on Earth.
- D) none of the above

39) Joshua is attracted toward Earth by a 500-N gravitational force. The Earth is attracted toward Joshua with a force of

- A) zero.
- B) 250 N.
- C) 500 N.
- D) 1000 N.

41) The force with which Earth pulls on the Moon is

- A) somewhat greater than Moon's pull on Earth.
- B) the only force acting between Earth and Moon.
- C) equal in magnitude to the force that Moon pulls on Earth.

44) A pair of toy freight cars, one twice the mass of the other, fly apart when a compressed spring that joins them is released. Acceleration will be greater for the

- A) heavier car.
- B) lighter car.
- C) same on each.

45) The force that propels a cannonball when fired from a cannon is

- A) huge compared to the recoil force on the cannon.
- B) equal and opposite to the force the ball exerts on the cannon.
- C) in some cases, equal and opposite to the force the ball exerts on the cannon.

46) When a cannonball is fired from a cannon, which undergoes the greater acceleration?

- A) the cannonball
- B) the recoiling cannon
- C) both the same

47) When a rocket forces exhaust gases downward, the exhaust gases

- A) as the name implies, soon exhaust their influence.
- B) play no further role in the motion of the rocket.
- C) exert an upward force on the rocket.

Short answer:

Write out Newton's First Law of motion.

Write out Newton's Second Law of motion.

Write out Newton's Third Law of motion.

