

Chapter 5 Momentum and Energy

5.1 Questions About Momentum

- 1) Which of the following has the largest momentum relative to the Earth?
- A) a tightrope walker crossing Niagara Falls
 - B) a pickup truck speeding along a highway
 - C) a Mack truck parked in a parking lot
 - D) the Science building on campus
 - E) a dog running down the street

Answer: B

Diff: 1

Topic: Momentum

- 2) The difference between impulse and impact force involves the
- A) distance the force acts.
 - B) time the force acts.
 - C) difference between acceleration and velocity.
 - D) mass and its effect on resisting a change in momentum.

Answer: B

Diff: 1

Topic: Momentum

- 3) It is correct to say that impulse is equal to
- A) momentum.
 - B) the change in momentum.
 - C) the force multiplied by the distance the force acts.
 - D) velocity multiplied by time

Answer: B

Diff: 1

Topic: Momentum

- 4) The impulse-momentum relationship is a direct result of
- A) Newton's 1st law.
 - B) Newton's 2nd law.
 - C) Newton's 3rd law.
 - D) Newton's 4th law.

Answer: B

Diff: 1

Topic: Momentum

5) The conservation of momentum is most closely related to

- A) Newton's 1st law.
- B) Newton's 2nd law.
- C) Newton's 3rd law.
- D) Newton's 4th law

Answer: C

Diff: 1

Topic: Momentum

6) A rifle recoils while firing a bullet. The speed of the rifle's recoil is small because the

- A) force against the rifle is smaller than against the bullet.
- B) momentum is mainly concentrated in the bullet.
- C) rifle has much more mass than the bullet.
- D) momentum of the rifle is smaller.

Answer: C

Diff: 1

Topic: Momentum

7) Suppose that a tiny gun made of a strong but very light material fires a bullet that is more massive than the gun itself. For such a weapon

- A) the target would be safer than the shooter.
- B) recoil problems would be lessened.
- C) conservation of energy would not hold.
- D) conservation of momentum would not hold.
- E) both conservation of energy and momentum would not hold.

Answer: A

Diff: 1

Topic: Momentum

8) Two objects have the same size and shape, but one is much heavier than the other. When they are dropped simultaneously from a tower, they reach the ground at the same time, but the heavier one has a greater

- A) speed.
- B) acceleration.
- C) momentum.
- D) all of these
- E) none of these

Answer: C

Diff: 1

Topic: Momentum

9) A large heavy truck and a small baby carriage roll down a hill. Neglecting friction, at the bottom of the hill, the baby carriage will have a greater

- A) speed.
- B) acceleration.
- C) momentum.
- D) all of these
- E) none of these

Answer: E

Diff: 2

Topic: Momentum

- 14) A bullet is fired from a gun. The speed of the bullet will be about the same as the speed of the recoiling gun
- A) because momentum is conserved.
 - B) because velocity is conserved.
 - C) because both velocity and momentum are conserved.
 - D) if the mass of the bullet equals the mass of the gun.
 - E) none of these

Answer: D

Diff: 2

Topic: Momentum

- 15) Padded dashboards in cars are safer in an accident than nonpadded ones because an occupant hitting the dash has
- A) increased time of impact.
 - B) decreased time of impact.
 - C) decreased impulse.
 - D) increased momentum.

Answer: A

Diff: 2

Topic: Momentum

- 16) The force on an apple hitting the ground depends upon
- A) the speed of the apple just before it hits.
 - B) the time of impact with the ground.
 - C) whether or not the apple bounces.
 - D) all of these

Answer: D

Diff: 2

Topic: Momentum

- 17) Compared to falling on a stone floor, a wine glass may not break when it falls on a carpeted floor because the
- A) carpeted floor provides a smaller impulse.
 - B) stopping time is shorter on the carpet.
 - C) stopping time is longer on the carpet.
 - D) carpet provides a smaller impulse and a longer time.

Answer: B

Diff: 2

Topic: Momentum

- 18) A 4 kg ball has a momentum of 12 kg m/s. What is the ball's speed?
- A) 3 m/s
 - B) 4 m/s
 - C) 12 m/s
 - D) 48 m/s
 - E) none of these

Answer: A

Diff: 2

Topic: Momentum

- 24) A piece of putty moving with 1 unit of momentum strikes and sticks to a heavy bowling ball that is initially at rest. After the putty sticks to the ball, both move with a combined momentum of
- A) less than 1 unit.
 - B) more than 1 unit.
 - C) 1 unit.
 - D) not enough information

Answer: C

Diff: 2

Topic: Momentum

- 25) A 1-kg chunk of putty moving at 1 m/s collides with and sticks to a 5-kg bowling ball initially at rest. The bowling ball and putty then move with a momentum of
- A) 0 kg m/s.
 - B) 1 kg m/s.
 - C) 2 kg m/s.
 - D) 5 kg m/s.
 - E) more than 5 kg m/s.

Answer: B

Diff: 2

Topic: Momentum

- 26) The force that accelerates a rocket in outer space is exerted on the rocket by the
- A) rocket's nose cone.
 - B) rocket's wings.
 - C) atmospheric pressure.
 - D) exhaust gases.
 - E) none of these

Answer: D

Diff: 2

Topic: Momentum

- 27) Two billiard balls having the same mass and speed roll toward each other. What is their combined momentum after they meet ?
- A) 0
 - B) half the sum of their original momentums.
 - C) twice the sum of their original momentums
 - D) impossible to determine without additional information

Answer: A

Diff: 2

Topic: Momentum

- 28) Compared to the force that brings a small car to a stop, the force required to bring a heavy truck to a stop
- A) is less.
 - B) is more.
 - C) is the same.
 - D) impossible to determine without additional information

Answer: D

Diff: 3

Topic: Momentum

- 33) A rifle of mass 2 kg is suspended by strings. The rifle fires a bullet of mass 0.01 kg at a speed of 200 m/s. The recoil velocity of the rifle is about
- A) 0.001 m/s.
 - B) 0.01 m/s.
 - C) 0.1 m/s.
 - D) 1 m/s.
 - E) none of these

Answer: D

Diff: 3

Topic: Momentum

- 34) A 5-kg fish swimming at a speed of 1 m/s swallows an absent-minded 1-kg fish at rest. The speed of the larger fish after this lunch is
- A) $1/2$ m/s.
 - B) $2/5$ m/s.
 - C) $5/6$ m/s.
 - D) $6/5$ m/s.
 - E) 1 m/s.

Answer: C

Diff: 3

Topic: Momentum

- 35) A 5-kg shark swimming at a speed of 1 m/s swallows an absent-minded 1-kg fish swimming toward it at 4 m/s. The speed of the shark after this meal is
- A) $1/2$ m/s.
 - B) $1/5$ m/s.
 - C) $1/6$ m/s.
 - D) $2/3$ m/s.
 - E) $3/2$ m/s.

Answer: C

Diff: 3

Topic: Momentum

- 36) A 1-kg chunk of putty moving at 1 m/s collides with and sticks to a 5-kg bowling ball that is initially at rest on a frictionless surface. The speed of the putty thereafter is
- A) $1/4$ m/s.
 - B) $1/5$ m/s.
 - C) $1/6$ m/s.
 - D) impossible to solve with the information given.

Answer: C

Diff: 3

Topic: Momentum

- 42) An astronaut, floating alone in outer space, throws a baseball. If the ball floats away at a speed of 20 meters per second, the astronaut will
- A) move in the opposite direction at a speed of 20 m/s.
 - B) move in the opposite direction, but at a lower speed.
 - C) move in the opposite direction but at a higher speed.
 - D) not move as stated in any of the above choices.

Answer: B

Diff: 3

Topic: Momentum

- 43) If a monkey floating in outer space throws his hat away, the hat and the monkey will both
- A) move away from each other, but at different speeds.
 - B) move away from each other at the same speed.
 - C) move a short distance and then slow down.
 - D) move a short distance and then go faster.
 - E) come to a stop after a few minutes.

Answer: A

Diff: 3

Topic: Momentum

- 44) A golf ball moving forward with 1 unit of momentum strikes and bounces backward off a heavy bowling ball that is initially at rest and free to move. The bowling ball is set in motion with a momentum of
- A) less than 1 unit.
 - B) more than 1 unit.
 - C) 1 unit.
 - D) not enough information

Answer: B

Diff: 3

Topic: Momentum

- 45) Consider massive gliders that slide friction-free along a horizontal air track. Glider A has a mass of 1 kg, a speed of 1 m/s, and collides with Glider B that has a mass of 5 kg and is at rest. If they stick upon collision, their speed after collision will be
- A) $1/4$ m/s.
 - B) $1/5$ m/s.
 - C) $1/6$ m/s.
 - D) 1 m/s.
 - E) none of these.

Answer: C

Diff: 3

Topic: Momentum

- 50) A sandbag is motionless in outer space. A second sandbag with 3 times the mass moving at 12 m/s collides with it. They stick together and move at a speed of
- 3 m/s.
 - 4 m/s.
 - 6 m/s.
 - 8 m/s.
 - none of these

Answer: E

Diff: 3

Topic: Momentum

- 51) The change in momentum, in kg m/s, that occurs when a 1.0 kg ball travelling at 4.0 m/s strikes a wall and bounces back at 2.0 m/s is
- 2.
 - 4.
 - 6.
 - 8.

Answer: C

Diff: 2

Topic: Momentum

2 Questions About Energy

- 1) If you push for a half hour or a whole hour against a stationary wall,
- no work is done in either case.
 - half as much work is done during the half hour.
 - twice as much work is done during the half hour.
 - it is impossible to determine how much work is done.

Answer: A

Diff: 1

Topic: Energy

- 2) If you push an object twice as far while applying the same force, you do
- twice as much work.
 - four times as much work.
 - the same amount of work.
 - half as much work.

Answer: A

Diff: 1

Topic: Energy

- 3) If you push an object a given distance, while applying twice the force, you do
- twice as much work.
 - four times as much work.
 - the same amount of work.
 - half as much work.

Answer: A

Diff: 1

Topic: Energy

- 9) If an object is raised twice as high, its potential energy will be
- A) half as much
 - B) twice as much.
 - C) four times as much.
 - D) impossible to determine unless the time is given.

Answer: B

Diff: 1

Topic: Energy

- 10) An object lifted 10 meters gains 200 J of potential energy. If the same object is lifted 20 meters, its potential energy gain is
- A) half as much.
 - B) the same.
 - C) twice as much.
 - D) four times as much.
 - E) more than four times as much.

Answer: C

Diff: 1

Topic: Energy

- 11) A 1000-kg car and a 2000-kg car are hoisted the same distance. Raising the more massive car requires
- A) less work.
 - B) as much work.
 - C) twice as much work.
 - D) four times as much work.
 - E) more than four times as much work.

Answer: C

Diff: 1

Topic: Energy

- 12) An object that has kinetic energy must be
- A) moving.
 - B) falling.
 - C) at an elevated position.
 - D) at rest.
 - E) none of these

Answer: A

Diff: 1

Topic: Energy

- 13) An object may have potential energy because of its
- A) speed.
 - B) acceleration.
 - C) momentum.
 - D) location.
 - E) none of these

Answer: D

Diff: 1

Topic: Energy

- 19) A hydraulic press, like a wheel and axle, is capable of multiplying force input.
- A) always true
 - B) always false
 - C) sometimes true
 - D) sometimes false

Answer: A

Diff: 1

Topic: Energy

- 20) After rolling halfway down an incline a marble's kinetic energy is
- A) less than its potential energy.
 - B) greater than its potential energy.
 - C) the same as its potential energy.
 - D) impossible to determine.

Answer: C

Diff: 1

Topic: Energy

- 21) The ball rolling down an incline has its maximum potential energy at
- A) the top.
 - B) a quarter of the way down.
 - C) halfway down.
 - D) the bottom.

Answer: A

Diff: 1

Topic: Energy

- 22) A ball rolling down an incline has its maximum kinetic energy at
- A) the top.
 - B) halfway down.
 - C) three-quarters of the way down.
 - D) the bottom.

Answer: D

Diff: 1

Topic: Energy

- 23) A block of ice sliding down an incline has its maximum speed at
- A) the top.
 - B) the bottom.
 - C) halfway down.
 - D) difficult to predict without knowing the slope of the incline
 - E) difficult to predict without knowing the coefficient of friction

Answer: B

Diff: 1

Topic: Energy

- 29) Both A 50-kg sack is lifted 2 meters from the ground and a 25-kg sack is lifted 4 meters in the same time. The power expended in raising the 50-kg sack is
- A) twice as much.
 - B) half as much.
 - C) the same.
 - D) impossible to predict without further information

Answer: C

Diff: 2

Topic: Energy

- 30) A TV set is pushed a distance of 2 m with a force of 20 N. How much work is done on the set?
- A) 2 J
 - B) 10 J
 - C) 20 J
 - D) 40 J
 - E) 800 J

Answer: D

Diff: 2

Topic: Energy

- 31) It takes 40 J to push a large box 4 m across a floor. Assuming the push is in the same direction as the move, what is the magnitude of the force on the box?
- A) 4 N
 - B) 10 N
 - C) 40 N
 - D) 160 N
 - E) none of these

Answer: B

Diff: 2

Topic: Energy

- 32) A 2-kg mass is held 4 m above the ground. What is the approximate potential energy of the mass with respect to the ground?
- A) 6 J
 - B) 8 J
 - C) 32 J
 - D) 80 J
 - E) none of these

Answer: D

Diff: 2

Topic: Energy

- 38) A car moves 4 times as fast as another identical car. Compared to the slower car, the faster car has
- A) 4 times the KE.
 - B) 8 times the KE.
 - C) 12 times the KE.
 - D) 16 times the KE.

Answer: D

Diff: 2

Topic: Energy

- 39) A ball is projected into the air with 100 J of kinetic energy which is transformed to gravitational potential energy at the top of its trajectory. When it returns to its original level after encountering air resistance, its kinetic energy is
- A) less than 100 J.
 - B) more than 100 J.
 - C) 100 J.
 - D) not enough information given

Answer: A

Diff: 2

Topic: Energy

- 40) Strictly speaking, more fuel is consumed by your car if an air conditioner, headlights, or even a radio is turned on. This statement is
- A) totally false.
 - B) true only if the car's engine is running fast.
 - C) true only if the car's engine is running slowly.
 - D) almost always true.

Answer: D

Diff: 2

Topic: Energy

- 41) A machine puts out 100 Watts of power for every 1000 Watts put into it. The efficiency of the machine is
- A) 10%.
 - B) 50%.
 - C) 90%.
 - D) 110%.
 - E) none of these

Answer: A

Diff: 2

Topic: Energy

- 42) A prize fighter's ungloved fist can do more damage to a jaw than a gloved fist. The reason for this is that the ungloved fist
- A) delivers a larger impulse to the jaw.
 - B) exerts a shorter impulse to the jaw.
 - C) has less air resistance.
 - D) none of these

Answer: B

Diff: 2

Topic: Energy

- 47) Consider a hydraulic press. When the input piston is depressed 20 cm, the output piston is raised 1 cm. On the same press, an input force of 1 N can lift a load of
- A) 1 N.
 - B) 10 N.
 - C) 15 N.
 - D) 20 N.
 - E) All of the above are correct.

Answer: E

Diff: 2

Topic: Energy

- 48) A 2500-N pile-driver ram falls 10 m and drives a post 0.1 m into the ground. The average impact force on the ram is
- A) 2,500 N.
 - B) 25,000 N.
 - C) 250,000 N.
 - D) 2,500,000 N.

Answer: C

Diff: 2

Topic: Energy

- 49) A pulley system raises a 1000-N load 2 meters with 100 N of input force. The efficiency of the system is
- A) 10%.
 - B) 90%.
 - C) 100%.
 - D) Not enough information is given.

Answer: D

Diff: 2

Topic: Energy

- 50) A jack system will increase the potential energy of a heavy load by 1000 J with a work input of 2000 J. The efficiency of the jack system is
- A) 10%.
 - B) 20%.
 - C) 50%.
 - D) 80%.
 - E) Not enough information is given.

Answer: C

Diff: 2

Topic: Energy

- 51) Which requires the most amount of work by the brakes of a car?
- A) slowing down from 100 km/h to 70 km/h
 - B) slowing down from 70 km/h to a stop
 - C) equal amounts for either

Answer: A

Diff: 3

Topic: Energy

- 57) A car's engine is 20% efficient. When cruising, the car encounters an average retarding force of 1000 N. If the energy content of gasoline is 40 megajoules per liter, how many kilometers per liter does the car get?
- A) 14
 - B) 12
 - C) 10
 - D) 8
 - E) none of these

Answer: D

Diff: 3

Topic: Energy

- 58) Suppose a miracle car has a 100% efficient engine and burns fuel that has a 40-megajoules-per-liter energy content. If the air drag and overall frictional forces on this car traveling at highway speeds total 1000 N, what is the overall limit in distance per liter it could be driven on the highway?
- A) 30 km
 - B) 40 km
 - C) 50 km
 - D) more than 50 km
 - E) not enough information

Answer: B

Diff: 3

Topic: Energy

- 59) On a sunny day about 500 watts of solar power are received by each of the four solar cells on the roof of a solar-powered automobile. If the solar cells were 100 % efficient, they would deliver
- A) 0.27 hp.
 - B) 2.7 hp.
 - C) 27 hp.
 - D) 270 hp.

Answer: B

Diff: 3

Topic: Energy

- 60) A flower pot of mass m falls from rest to the ground below, a distance h . Which statement is correct?
- A) The speed of the pot when it hits the ground is proportional to h .
 - B) The KE of the pot when it hits the ground is proportional to h .
 - C) The KE of the pot when it hits the ground does not depend on m .
 - D) The speed of the pot when it hits the ground depends on m .
 - E) None of these are correct.

Answer: B

Diff: 3

Topic: Energy

6) If the speed of a moving object doubles, which of the following also doubles?

- A) momentum
- B) kinetic energy
- C) acceleration
- D) all of the above

Answer: A

Diff: 1

Topic: Energy/Momentum

7) An object at rest may also have

- A) speed.
- B) velocity.
- C) momentum.
- D) kinetic energy.
- E) potential energy.

Answer: E

Diff: 2

Topic: Energy/Momentum

8) A feather and a coin dropped in a vacuum fall with equal

- A) forces.
- B) momenta.
- C) accelerations.
- D) kinetic energies.
- E) none of these

Answer: C

Diff: 2

Topic: Energy/Momentum

9) A heavy and a light object released from the same height in a vacuum have equal

- A) weights.
- B) momenta.
- C) kinetic energies.
- D) accelerations.
- E) none of the above

Answer: D

Diff: 2

Topic: Energy/Momentum

10) Two pool balls, each moving at 2 m/s, roll toward each other and collide. Suppose after bouncing apart, each moves at 4 m/s. This collision violates conservation of

- A) momentum.
- B) energy.
- C) both momentum and energy.
- D) none of the above choices

Answer: B

Diff: 2

Topic: Energy/Momentum

- 16) The total momentum of a flock of identical birds could be zero only if the birds are
- A) taking off from the ground.
 - B) flying in the same direction.
 - C) flying in different directions.
 - D) very tired and coming down to rest.

Answer: C

Diff: 3

Topic: Energy/Momentum

- 17) A golf ball is thrown at and bounces backward from a massive bowling ball that is initially at rest. After the collision, compared to the golf ball, the bowling ball has
- A) more momentum, but less kinetic energy.
 - B) more kinetic energy, but less momentum.
 - C) more momentum and more kinetic energy.
 - D) less momentum and less kinetic energy.
 - E) Not enough information is given to say.

Answer: A

Diff: 3

Topic: Energy/Momentum

- 18) A piece of taffy slams into and sticks to another identical piece of taffy that is at rest. The momentum of the two pieces stuck together after the collision is the same as it was before the collision, but this is not true of the kinetic energy, which is partly turned into heat. What percentage of the kinetic energy is turned into heat?
- A) 0%
 - B) 25%
 - C) 50%
 - D) 75%
 - E) not enough information given

Answer: C

Diff: 3

Topic: Energy/Momentum

- 19) Two identical freight cars roll without friction (one at 1 m/s, the other at 2 m/s) toward one another on a level track. They collide, couple together, and roll away in the direction that
- A) the slower car was initially going.
 - B) the faster car was initially going.
 - C) neither of these – they stop.

Answer: B

Diff: 3

Topic: Energy/Momentum