

Review Packet : Chapter 6– Mrs. Merrill

Name: _____ Class: _____ Date: _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) The momentum of an object is defined as the object's _____. 1) _____
 - A) force times its acceleration.
 - B) force times the time interval.
 - C) velocity times the time interval.
 - D) mass times its velocity.
 - E) mass times its acceleration.

- 2) Which has more momentum, a large truck moving at 30 miles per hour or a small truck moving at 30 miles per hour? 2) _____
 - A) The small truck
 - B) Both have the same momentum.
 - C) The large truck

- 3) Compared to a sports car moving at 30 miles per hour, the same sports car moving at 60 miles per hour has _____. 3) _____
 - A) twice as much momentum.
 - B) four times as much momentum.
 - C) the same momentum.

- 4) If the momentum of an object changes and its mass remains constant, _____. 4) _____
 - A) it is accelerating (or decelerating).
 - B) there is a force acting on it.
 - C) its velocity is changing.
 - D) all of the above
 - E) none of the above

- 5) The momentum change of an object is equal to the _____. 5) _____
 - A) velocity change of the object.
 - B) force acting on it times its velocity.
 - C) impulse acting on it.
 - D) object's mass times the force acting on it.
 - E) force acting on it.

- 6) In order to increase the final momentum of a golf ball, we could _____. 6) _____
 - A) swing as hard as possible.
 - B) increase the time of contact with the ball.
 - C) increase the force acting on it.
 - D) follow through when hitting the ball.
 - E) all of the above

- 7) In order to increase the final momentum of a golf ball, we could _____. 7) _____
- A) increase the force acting on it.
 - B) follow through when hitting the ball.
 - C) increase the time of contact with the ball.
 - D) swing as hard as possible.
 - E) all of the above
- 8) The reason padded dashboards are used in cars is that they _____. 8) _____
- A) increase the force of impact in a collision.
 - B) increase the time of impact in a collision.
 - C) decrease the momentum of a collision.
 - D) look nice and feel good.
 - E) decrease the impulse in a collision.
- 9) A Ping-Pong® ball launcher is fired. Compared to the force on the ball, the force on the launcher is _____ 9) _____
- A) the same.
 - B) smaller.
 - C) larger.
- 10) A Ping-Pong® ball launcher is fired. Compared to the impulse on the ball, the impulse on the launcher is _____. 10) _____
- A) smaller.
 - B) larger.
 - C) the same.
- 11) Momentum of a system is conserved only when _____. 11) _____
- A) the system has zero momentum.
 - B) the system is not moving.
 - C) there is no net external force acting on the system.
 - D) there are no internal forces acting on the system.
 - E) there are no forces acting on the system.
- 12) A collision is considered elastic if _____. 12) _____
- A) there is no lasting deformation.
 - B) the objects that collide don't get hot.
 - C) there is no sound generated during the collision.
 - D) after the collision, the objects have the same shape as before the collision.
 - E) all of the above
- 13) Suppose a girl is standing on a pond where there is no friction between her feet and the ice. In order to get off the ice, she can _____. 13) _____
- A) throw something in the direction opposite to that in which she wants to go.
 - B) get on her hands and knees and crawl off the ice.
 - C) bend over touching the ice in front of her, then bring her feet to her hands.
 - D) walk very slowly on tiptoe.
 - E) all of the above will work

- 14) Which of the following has the largest momentum? 14) _____
- A) The science building at your school
 - B) A dog running down the street
 - C) A pickup truck traveling down the highway
 - D) A Mack truck parked in a parking lot
 - E) A tightrope walker crossing Niagara Falls
- 15) A freight train rolls along a track with considerable momentum. If it were to roll at the same speed but had twice as much mass, its momentum would be _____. 15) _____
- A) unchanged.
 - B) doubled.
 - C) quadrupled.
 - D) zero.
- 16) A cannon recoils from launching a cannonball. The speed of the cannon's recoil is small because the _____. 16) _____
- A) force against the cannon is relatively small.
 - B) cannon has far more mass than the cannonball.
 - C) impulse on the cannon is less than the impulse on the cannonball.
 - D) momentum of the cannon is unchanged.
 - E) none of the above
- 17) Suppose a cannon is made of a strong but very light material. Suppose also that the cannonball is more massive than the cannon itself. For such a system _____. 17) _____
- A) conservation of momentum would not hold.
 - B) the force on the cannonball would be greater than the force on the cannon.
 - C) the target would be a safer place than where the operator is located.
 - D) recoil problems would be lessened.
 - E) conservation of energy would not hold.
- 18) Two objects, A and B, have the same size and shape, but A is twice as heavy as B. When they are dropped simultaneously from a tower, they reach the ground at the same time, but A has a higher _____. 18) _____
- A) momentum.
 - B) acceleration.
 - C) speed.
 - D) all of the above
 - E) none of the above
- 19) In order to catch a ball, a baseball player moves his or her hand backward in the direction of the ball's motion. Doing this reduces the force of impact on the player's hand principally because _____. 19) _____
- A) the time of impact is decreased.
 - B) the time of impact is increased.
 - C) the velocity of the hand is reduced.
 - D) the momentum of impact is reduced.
 - E) none of the above

- 20) A car traveling along the highway needs a certain amount of force exerted on it to stop. More stopping force may be required when the car has _____. 20) _____
- A) more momentum.
 - B) less stopping distance.
 - C) more mass.
 - D) all of the above
 - E) none of the above
- 21) A cannon fires a cannonball. The speed of the cannonball will be the same as the speed of the recoiling cannon _____. 21) _____
- A) because both velocity and momentum are conserved.
 - B) if the mass of the cannonball equals the mass of the cannon.
 - C) because velocity is conserved.
 - D) because momentum is conserved.
 - E) none of the above
- 22) The force of an apple hitting the ground depends upon _____. 22) _____
- A) the speed of the apple just before it hits.
 - B) air resistance on the apple as it falls.
 - C) the time of impact with the ground.
 - D) whether or not the apple bounces.
 - E) all of the above
- 23) When you jump off a step, you usually bend your knees as you reach the ground. By doing this, the time of the impact is about 10 times more what it would be in a stiff-legged landing and the average force on your body is reduced by _____. 23) _____
- A) more than 10 times.
 - B) less than 10 times.
 - C) about 10 times.
- 24) Recoil is noticeable if we throw a heavy ball while standing on roller skates. If instead we go through the motions of throwing the ball but hold onto it, our net recoil velocity will be _____. 24) _____
- A) small but noticeable.
 - B) the same as before.
 - C) zero.
- 25) A 1-N apple falls to the ground. The apple hits the ground with an impact force of about _____. 25) _____
- A) 1 N.
 - B) 9.8 N.
 - C) 4 N.
 - D) 2 N.
 - E) Not enough information to say

- 26) A karate expert executes a swift blow and severs a cement block with her bare hand. 26) _____
- A) The force on both the block and the expert's hand have the same magnitude.
 - B) The time of impact on both the block and the expert's hand is the same.
 - C) The impulse on both the block and the expert's hand have the same magnitude.
 - D) all of the above
 - E) none of the above
- 27) A moving freight car runs into an identical car at rest on the track. The cars couple together. 27) _____
 Compared to the velocity of the first car before the collision, the velocity of the combined cars after the collision is _____.
- A) twice as large.
 - B) one half as large.
 - C) More information is needed to say.
 - D) the same.
 - E) zero.
- 28) Two gliders having the same mass and speeds move toward each other on an air track and stick 28) _____
 together. After the collision the velocity of the gliders is _____.
- A) zero.
 - B) twice the original velocity.
 - C) There is not enough information to say.
 - D) the same as the original velocity.
 - E) one half the original velocity.
- 29) A piece of putty moving with 1 unit of momentum strikes and sticks to a heavy bowling ball that is 29) _____
 initially at rest. After the putty sticks to the ball, both are set in motion with a combined momentum that is _____.
- A) Not enough information to say
 - B) more than 1 unit.
 - C) less than 1 unit.
 - D) 1 unit.
- 30) The force that accelerates a rocket into outer space is exerted on the rocket by the _____. 30) _____
- A) Earth's gravity.
 - B) exhaust gases.
 - C) rocket's wings.
 - D) atmospheric pressure.
 - E) none of the above
- 31) If all people, animals, trains and trucks all over the world began to walk or run towards the east, 31) _____
 then _____.
- A) the earth's spin would not be affected at all.
 - B) the earth would spin a bit slower.
 - C) the earth would spin a bit faster.

- 32) Suppose an astronaut in outer space wishes to play a solitary "throw, bounce, and catch" game by tossing a ball against a very massive and perfectly elastic concrete wall. If the ball is as massive as the astronaut, then _____ 32) _____
- A) the astronaut's time between catches will decrease as the game progresses.
 - B) the astronaut will catch one bounce only.
 - C) the astronaut will never catch the first bounce.
 - D) none of the above
- 33) 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 _____ 33) _____
- A) more than 1 unit.
 - B) 1 unit.
 - C) less than 1 unit.
 - D) not enough information
- 34) Superman is at rest in space when he throws an asteroid that has more mass than he does. Which moves faster, Superman or the asteroid? 34) _____
- A) They both move at the same speed.
 - B) Superman
 - C) The asteroid
- 35) A cannonball shot from a long-barrel cannon travels faster than one shot from a short-barrel cannon because the cannonball receives a greater _____ 35) _____
- A) impulse.
 - B) force.
 - C) both A and B
 - D) neither A nor B
- 36) While rollerblading, Granny collides with her tiny grandson Ambrose who is at rest. Ignoring any friction effects, Ambrose's speed after the collision will be greatest when _____ 36) _____
- A) he and Granny make a bouncing collision, each going separate ways.
 - B) Granny catches him and they both move together.
- 37) A small economy car (low mass) and a limousine (high mass) are pushed from rest across a parking lot, equal distances with equal forces. The car that receives the greater impulse is the _____ 37) _____
- A) small economy car.
 - B) limousine.
 - C) neither A nor B (same for each)
- 38) A 2-kg ball is thrown at 3 m/s. What is the ball's momentum? 38) _____
- A) 3 kg m/s
 - B) 6 kg m/s
 - C) 9 kg m/s
 - D) 2 kg m/s
 - E) none of the above

- 46) 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. The bowling ball with its putty passenger will then be set in motion with a momentum of _____.
- A) 1 kg m/s.
B) 5 kg m/s.
C) more than 5 kg m/s.
D) 2 kg m/s.
E) 0 kg m/s.

- 47) 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 m/s.
B) 1/6 m/s.
C) 1/4 m/s.
D) 1/5 m/s.
E) none of these.

TRUE/FALSE. Write the WORD True or False in the space provided.

- 48) Momentum is defined as an object's mass times its velocity. 48) _____
- 49) Impulse is defined as the force exerted on an object times the time it lasts. 49) _____
- 50) If the net external force acting on a system is zero, then the total momentum of the system is zero. 50) _____
- 51) When two objects collide and completely bounce apart with no lasting deformation or generation of heat, the collision is said to be elastic. 51) _____
- 52) When two objects collide and completely stick together, the collision is said to be inelastic. 52) _____
- 53) Impulses are normally smaller when bouncing takes place. 53) _____
- 54) Perfectly elastic collisions between large objects are uncommon in the everyday world. 54) _____
- 55) When a baseball player follows through when hitting the ball, the contact time with the ball is longer. 55) _____
- 56) Automobile dashboards that are padded lengthen the time of impact in case of a collision. 56) _____
- 57) If a net force acts on a system, the system's momentum will change. 57) _____
- 58) Momentum is a scalar quantity. 58) _____

SHORT ANSWERS: Answer the following questions in as much detail as possible using the physics principles learned in class. SHOW ALL WORK for math problems as we do in class.

59) In terms of momentum change, explain why it is best to "give" when catching a baseball. Provide other examples of situations in which you want to lengthen the impact time in a collision. 59) _____

60) An unfortunate bug splatters on the windshield of a moving car. Describe the forces, impulses, momentum changes, and accelerations of both the bug and the car. 60) _____

61) A boy fires a Ping-Pong ball launcher. Briefly describe the forces and impulses on the launcher and the ball. Which has more momentum? Which is moving faster? Explain. 61) _____

62) What does it mean to say that momentum is conserved? Give at least two examples where momentum is conserved in a collision. 62) _____

- 63) A railroad diesel engine coasting at 10 km/h runs into a stationary flatcar. The diesel weighs 4 times as much as the flatcar. Assuming the cars couple together, how fast are they moving after the collision? 63) _____
- 64) What is the average momentum of a 50-kg runner who is running with a speed of 8 m/s ? 64) _____
- 65) A cement truck of mass $16,000\text{kg}$ moving at 15 m/s slams into a cement wall and comes to a halt in 2 s . What is the force of impact on the truck? 65) _____
- 66) A 10-kg cement block moving horizontally at 2.0 m/s plows into a pillow and comes to a stop in 0.5 s . What is the average impact force on the pillow? 66) _____
- 67) A 8.0-kg blob of clay moving horizontally at 2.0 m/s hits a 4.0-kg blob of clay at rest. What is the speed of the two blobs stuck together immediately after the collision? 67) _____
- 68) A 40-kg football player leaps through the air to collide with and tackle a 60-kg player heading toward him, also in the air. If the 40-kg player is heading to the right at 7.0 m/s , and the 60-kg player is heading toward the left at 3.0 m/s , what is the speed and direction of the tangled players? 68) _____

- 69) A 5.0-kg blob of clay moving horizontally at 2.0 m/s has a head-on collision with a 6.0-kg blob of clay that moves toward it at 1.0 m/s. What is the speed of the two blobs stuck together immediately after the collision? 69) _____
- 70) A 10-kg bowling ball moving at 4.0 m/s bounces off a spring at about the same speed that it had before bouncing. What is the change in momentum of the bowling ball? 70) _____
- 71) A loaded freight car has 5 times as much mass as an empty freight car that has a mass of 1000 kg. If the loaded car coasts at 2.0 m/s and collides with and attaches to the empty car at rest, what will be the speed of both cars after collision? 71) _____
- 72) An 80-kg cart moving at 70 km/h collides head-on with an approaching 120-kg cart moving at 40 km/h (in the opposite direction). If the two carts stick together, what will be their speed? 72) _____
- 73) A 30-kg girl and a 25-kg boy face each other on friction-free roller skates. The girl pushes the boy, who moves away at a speed of 2.0 m/s. What is the girl's speed? 73) _____
- 74) A 100-kg free-floating astronaut fires 0.10 kg of gas at a speed of 50.0 m/s from her propulsion pistol. What is the astronaut's recoil speed? 74) _____
- 75) Assume that a 20-kg ball moving at 7.0 m/s strikes a wall perpendicularly and rebounds elastically at the same speed. What is the amount of impulse given to the wall? 75) _____

Answer Key

Testname: REV PACKET CH6NEW

- 1) D
- 2) C
- 3) A
- 4) D
- 5) C
- 6) E
- 7) E
- 8) B
- 9) A
- 10) C
- 11) C
- 12) E
- 13) A
- 14) C
- 15) B
- 16) B
- 17) C
- 18) A
- 19) B
- 20) D
- 21) B
- 22) E
- 23) C
- 24) C
- 25) E
- 26) D
- 27) B
- 28) A
- 29) D
- 30) B
- 31) B
- 32) C
- 33) A
- 34) B
- 35) A
- 36) A
- 37) B
- 38) B
- 39) A
- 40) D
- 41) D
- 42) A
- 43) B
- 44) D
- 45) C
- 46) A
- 47) B
- 48) TRUE
- 49) TRUE
- 50) FALSE

Answer Key

Testname: REV PACKET CH6NEW

- 51) TRUE
- 52) TRUE
- 53) FALSE
- 54) TRUE
- 55) TRUE
- 56) TRUE
- 57) TRUE
- 58) FALSE
- 59) The force of impact in catching a ball will be less if the time of impact is lengthened. Other situations in which you want to lengthen the time of impact might be in a car or bicycle collision, in catching a soccer ball, and in hitting a baseball (to give it the most momentum you can).
- 60) According to Newton's third law, the force of collision will be the same on both the bug and the car, but will act in opposite directions. The time during which the force acts is the same for both, so the impulses on the bug and the car will be equal in magnitude but opposite in direction. This means that they will undergo equal and opposite changes in momentum. (It is important to stress that their momenta are not the same, but that they change by the same amount! The car loses as much momentum as the bug gains in the collision.) Because of the small mass of the bug, its acceleration will be very large. Because of the large mass of the car, its acceleration will be unnoticeable.
- 61) The force and impulse on the ball and on the launcher have the same magnitudes but opposite directions. This means they undergo equal and opposite changes in momentum. Since they began with no momentum, they have equal and opposite momenta as the ball is fired and the launcher recoils. However, the mass of the ball is less than the mass of the launcher, so the ball will move at a correspondingly greater speed.
- 62) Conservation of momentum means that in a given system and situation where no external forces are acting, net momentum is neither created nor destroyed. For example, momentum is conserved in collisions and explosions, where the forces that act are internal. So the momentum of the colliding or exploding bodies before the event is the same as the momentum after. On the other hand, when you drop a rock, the momentum of the rock changes because the force of gravity acts on it; however, if you consider the rock and the earth as one system, then the earth and the rock each acquire the same amount of momentum, but in opposite directions, so the total momentum of the system is and remains zero.
- 63) Momentum before the collision = mass of engine times 10 km/h. Momentum after the collision = $\frac{5}{4}$ times mass of engine times v . Equating the two expressions, and solving for v gives, $v = (10 \text{ km/h})(\frac{4}{5}) = 8 \text{ km/h}$.
- 64) 400 kg m/s
- 65) 120000 N
- 66) 40 N
- 67) 1.3 m/s
- 68) 1.0 m/s toward the right
- 69) 0.36 m/s
- 70) 80 kg m/s
- 71) 1.7 m/s
- 72) 4 km/h
- 73) 1.7 m/s
- 74) 0.05 m/s
- 75) 280 N s