Physics 06 **HW Ch 07 Conservation of Momentum** Name_____

1) A rubber ball and a lump of clay have equal mass. They are thrown with equal speed against a wall. The ball bounces back with nearly the same speed with which it hit. The clay sticks to the wall. Which one of these objects experiences the greater momentum change?
   A) the ball
   B) the clay
   C) Both of them experience the same non–zero momentum change.
   D) Both of them experience zero momentum change.

2) A tiger is running in a straight line. If we double both the mass and speed of the tiger, the magnitude of its momentum will increase by what factor?
   A) 8 B) 16 C) 4 D) 2 E) $\sqrt{2}$

3) A very elastic rubber ball is dropped from a certain height and hits the floor with a downward speed v. Since it is so elastic, the ball bounces back with the same speed v going upward. Which of the following statements about the bounce are correct? (There could be more than one correct choice.)
   A) The ball had the same momentum just before and just after the bounce.
   B) The ball's momentum was conserved during the bounce.
   C) The magnitude of the ball's momentum was the same just before and just after the bounce.
   D) None of the above statements are correct.

4) The momentum of an isolated system is conserved
   A) in both elastic and inelastic collisions.
   B) only in inelastic collisions.
   C) only in elastic collisions.

5) Two friends are standing on opposite ends of a canoe that is initially at rest with respect to a frictionless lake. The person in the front throws a very massive ball toward the back, and the person in the back catches it. After the ball is caught, the canoe is
   A) stationary. B) moving backward. C) moving forward.

6) You are standing on a skateboard, initially at rest. A friend throws a very heavy ball towards you. You have two choices about what to do with the ball: either catch the ball or deflect it back toward your friend with the same speed as it was originally thrown. Which choice should you make in order to maximize your speed on the skateboard?
   A) Deflect the ball back.
   B) Catch the ball.
   C) Your final speed on the skateboard will be the same regardless whether you catch the ball or deflect the ball.

7) A small car meshes with a large truck in a head–on collision. Which of the following statements concerning the magnitude of the momentum change during the collision is correct? (There could be more than one correct choice.)
   A) The small car and the truck experience the same magnitude momentum change.
   B) The truck experiences the greater magnitude momentum change.
   C) The magnitude of the momentum change experienced by each one is inversely proportional to its mass.
   D) The small car experiences the greater magnitude momentum change.
   E) The magnitude of the momentum change experienced by each one is directly proportional to its mass.

8) Consider two less–than–desirable options. In the first you are driving 30 mph and crash head–on into an identical car also going 30 mph. In the second option you are driving 30 mph and crash head–on into a stationary brick wall. In neither case does your car bounce back from the thing it hits, and the collision time is the same in both cases. Which of these two situations would result in the greater impact force on your car?

A) The force would be the same in both cases. B) hitting the other car
C) hitting the brick wall D) None of the above choices are correct.

9) A rocket explodes into two fragments, one 25 times heavier than the other. The magnitude of the momentum change of the lighter fragment is

A) 5 times as great as the momentum change of the heavier fragment.
B) 25 times as great as the momentum change of the heavier fragment.
C) 1/25 as great as the momentum change of the heavier fragment.
D) 1/4 as great as the momentum change of the heavier fragment.
E) The same as the momentum change of the heavier fragment.

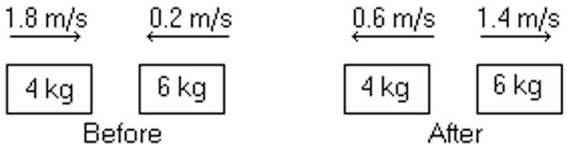
10) Three cars, car X, car Y, and car Z, begin accelerating from rest at the same time. Car X is more massive than car Y, which is more massive than car Z. The net accelerating force exerted on each car is identical. After 10 seconds, which car has the most amount of momentum?

A) They all have the same amount of momentum. B) Car X
C) Car Y D) Car Z

11) A very light ping–pong ball moving east at a speed of 4 m/s collides with a very heavy stationary bowling ball. The Ping–Pong ball bounces back to the west, and the bowling ball moves very slowly to the east. Which object experiences the greater magnitude impulse during the collision?

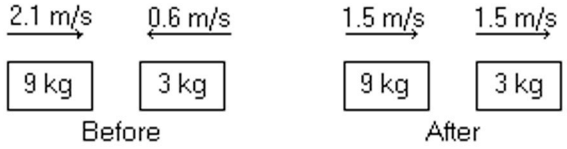
A) Neither; both experienced the same magnitude impulse.
B) the bowling ball
C) the Ping–Pong ball
D) It is impossible to tell since the actual mass values are not given.
E) It is impossible to tell since the velocities after the collision are unknown.

12) In the figure, determine the character of the collision. The masses of the blocks, and the velocities before and after, are shown. The collision is



A) perfectly elastic.
B) completely inelastic.
C) partially inelastic.
D) characterized by an increase in kinetic energy.
E) not possible because momentum is not conserved.

13) In the figure showing an isolated system, determine the character of the collision. The masses of the blocks, and the velocities before and after, are shown. The collision is



A) completely inelastic.
B) perfectly elastic.
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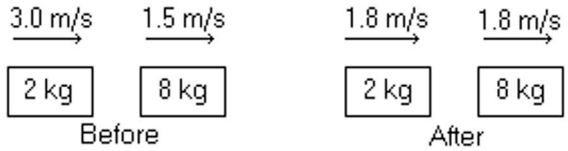
14) In the figure, determine the character of the collision. The masses of the blocks, and the velocities before and after, are shown. The collision is



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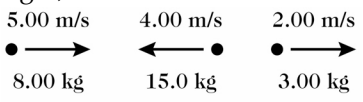
15) An egg falls from a bird's nest in a tree and feels no effects due to the air. As it falls,
A) both its kinetic energy and its momentum are conserved.
B) only its momentum is conserved.
C) both its mechanical energy and its momentum are conserved.
D) only its kinetic energy is conserved.
E) only its mechanical energy is conserved.

16) A rubber ball bounces off of a wall with an initial speed v and reverses its direction so its speed is v right after the bounce. As a result of this bounce, which of the following quantities of the ball are conserved? (There could be more than one correct choice.)
A) the momentum of the ball
B) the kinetic energy of the ball
C) both the momentum and the kinetic energy of the ball
D) None of the above quantities are conserved.

17) A firecracker explodes in midair and breaks up into many fragments. Which of the following statements are true regarding conditions immediately before and immediately after the explosion:
I. The total momentum of the fragments is equal to the original momentum of the firecracker.
II. The total kinetic energy of the fragments is equal to the original kinetic energy of the firecracker.
A) Statement I only
B) Statement II only
C) Both Statement I and Statement II
D) Neither statement is true.

18) A 0.14–kg baseball is dropped from rest from a height of 2.0 m above the ground. What is the magnitude of its momentum just before it hits the ground if we neglect air resistance?

19) Three objects are moving along a straight line as shown in the figure. Taking the positive direction to be to the right, what is the total momentum of this system?



20) Two air track carts move along an air track towards each other. Cart A has a mass of 450 g and moves toward the right with a speed of 0.850 m/s. Cart B has a mass of 300 g and moves toward the left with a speed of 1.12 m/s. What is the total momentum of the two–cart system?

21) A 0.10–kg ball, traveling horizontally at 25 m/s, strikes a wall and rebounds at 19 m/s. What is the magnitude of the change in the momentum of the ball during the rebound?

22) A 60–kg swimmer suddenly dives horizontally from a 150–kg raft with a speed of 1.5 m/s. The raft is initially at rest. What is the speed of the raft immediately after the diver jumps if the water has negligible effect on the raft?

23) In a police ballistics test, 2.00–g bullet traveling at 700 m/s suddenly hits and becomes embedded in a stationary 5.00–kg wood block. What is the speed of the block immediately after the bullet has stopped moving relative to the block?

24) A 328–kg car moving at 19.1 m/s in the $+x$ direction hits from behind a second car moving at 13.0 m/s in the same direction. If the second car has a mass of 790 kg and a speed of 15.1 m/s right after the collision, what is the velocity of the first car after this sudden collision?

25) A 1200–kg ore cart is rolling at 10.8 m/s across a flat friction–free surface. A crane suddenly drops 858 kg of ore vertically into the cart. How fast does the cart move just after being loaded with the ore?

26) In a police ballistics test, a 10.0–g bullet moving at 300 m/s is fired into a 1.00–kg block at rest. The bullet goes through the block almost instantaneously and emerges with 50.0% of its original speed. What is the speed of the block just after the bullet emerges?

27) Two astronauts, of masses 60 kg and 80 kg, are initially right next to each other and at rest in outer space. They suddenly push each other apart. What is their separation after the heavier astronaut has moved 12 m?

28) A batter applies an average force of 8000 N to a baseball for 1.1 ms. What is the magnitude of the impulse delivered to the baseball by the bat?

29) A 0.24 kg blob of clay is thrown at a wall with an initial horizontal velocity of 16 m/s. If the clay comes to a stop in 91 ms, what is the average horizontal force on the clay due to the wall?

30) A 320–g air track cart traveling at 1.25 m/s suddenly collides elastically with a stationary 270–g cart. What is the speed of the 270–g cart just after the collision?

31) A car heading north suddenly collides at an intersection with a truck of the same mass heading east. If they lock together and travel at 28 m/s at 15° north of east just after the collision, how fast was the car initially traveling?

32) In a police ballistics test, a 2.00–g bullet suddenly hits and becomes embedded in a 5.00–kg wood block which is hanging from a 1.20–m long string. This causes the block to swing through an arc of 3.50°. What was the speed of the bullet just before it hit the block?

33) Three small masses are positioned as follows: 2.0 kg at (0.0 m, 0.0 m), 2.0 kg at (2.0 m, 0.0 m), and 4.0 kg at (2.0 m, 1.0 m). Determine the coordinates of the center of mass (or center of gravity) of this system.

34) Consider the sun and its largest planet Jupiter. On the line joining them, how far from the center of the sun is their center mass? Is it within or outside the sun? (Jupiter–sun distance is 778×10^6 km, diameter of the sun is 1.4×10^6 km, the sun is 1000 times as massive as Jupiter)

Answer Key
Testname: HW_CH07_CONSERVATION_OF_MOMENTUM

1) A
2) C
3) C
4) A
5) A
6) A
7) A
8) A
9) E
10) A
11) A
12) A
13) E
14) B
15) E
16) B
17) A
18) 0.88 kg • m/s
19) –14.0 kg • m/s
20) 0.047 kg • m/s toward the right
21) 4.4 kg • m/s
22) 0.60 m/s
23) 0.280 m/s
24) 14.0 m/s
25) 6.30 m/s
26) 1.50 m/s
27) 28 m
28) 8.8 N • s
29) 42 N
30) 1.36 m/s
31) 14 m/s
32) 524 m/s
33) (1.5 m, 0.50 m)
34) 0.78×10^6 km from the center of the sun, just outside the solar surface