CONCEPTUAL QUESTIONS

MOMENTUM CHAPTER

1.) Object 1 has more kinetic energy than Object 2. How do the magnitudes of their momenta compare?

a. $p_1 = p_2$
b. $p_1 > p_2$
c. $p_1 < p_2$
d. not enough information given to tell.

2.) Your gym teacher throws a large and heavy medicine ball to you for you to catch. She is next going to throw to you a baseball that has a mass that is one tenth of that of the medicine ball. You are given the following choices. You can have the baseball thrown with (i) the same speed as the medicine ball, (ii) the same momentum as the medicine ball, and (iii) the same kinetic energy as the medicine ball. Rank these choices from the slowest to the fastest speed of the baseball.

a. (i), (ii), (iii)
b. (i), (iii), (ii)
c. (ii), (iii), (i)
d. (iii), (ii), (i)

3.) A boulder falls off a cliff toward the ground with no air resistance. The isolated system for which momentum is conserved is:

a. only the earth.
b. only the boulder.
c. both the earth and the boulder.
d. none of these.

4.) A car and a large truck make a head-on collision and stick together. Prior to the collision, the truck's velocity was twice that of the car. Which vehicle experiences the larger change in the magnitude of its momentum?

a. the car
b. the truck
c. Both vehicles experience the same magnitude change in momentum.
d. impossible to determine.

5.) (DON'T BOTHER DOING) Two objects are at rest on a frictionless surface. Object 1 has a mass that is four times that of Object 2. When a constant force is applied to Object 1, it accelerates through a distance *d*. The force is removed from Object 1 and is applied to Object 2. At the moment when Object 2 has accelerated through the same distance *d*, which statements are true?

(i) $p_2 = 2p_1$

(ii) $p_2 = p_1$

(iii) $p_2 = \frac{1}{2} p_1$

(iv) $KE_2 = 2KE_1$

(v) $KE_2 = KE_1$

(vi) $KE_2 = {}^{1}\!/_{2} KE_1$

a. (i) and (iv)
b. (ii) and (vi)
c. (i) and (v)
d. (iii) and (v)

6.) Two objects are at rest on a frictionless surface. Object 1 has a mass that is twice that of Object 2. When a constant force is applied to Object 1, it accelerates for a time interval. The force is removed from Object 1 and is then applied to Object 2. After Object 2 has been accelerated for the same time interval, which statements are true?

(i) $p_2 = 2p_1$

(ii) $p_2 = p_1$

(iii) $p_2 = \frac{1}{2} p_1$

(iv) $KE_2 = 2KE_1$

(v) $KE_2 = KE_1$

(vi) $KE_2 = {}^{1}\!/_{2} KE_1$

a. (i) and (vi)
b. (ii) and (iv)
c. (i) and (v)
d. (iii) and (v)

7.) In a perfectly inelastic one-dimensional collision between two objects, what condition alone is necessary so that *all* of the original kinetic energy of the system is gone after the collision?

a. The objects must have the same mass.
b. The objects must have momenta with the same magnitude but opposite directions.
c. The objects must have velocities of the same magnitude and opposite directions.
d. Because energy is conserved, you will always have the same energy before and after the collision, so there is no such condition.

8.) Which of the following expressions relates the kinetic energy, *KE*, of an object of mass *m* to its momentum, *p*?

a. $KE = 2mp$
B $KE = 2mp^2$.
c. $KE = \frac{p^2}{2m}$
d. $KE = \sqrt{\frac{p^2}{2m}}$

9.) A small rubber ball is thrown at an initially stationary bowling ball on a frictionless surface. The rubber ball makes a one-dimensional elastic collision and bounces back along the same line. After the collision, compared to the bowling ball, the rubber ball has:

a. a larger magnitude of momentum and more kinetic energy.
b. a smaller magnitude of momentum and less kinetic energy.
c. a smaller magnitude of momentum and more kinetic energy.
d. the same magnitude of momentum and more kinetic energy.

10. You are at the leading end of a canoe and your friend is at the trailing end while the canoe is drifting along at a speed *v*. You toss a backpack to your friend. While the backpack is in flight, what is the canoe's speed? Ignore any friction effects between the canoe and the water.

a. It is greater than *v*.
b. It is less than *v*.
c. It maintains the same speed it had before the backpack was thrown.
d. We cannot tell from the information given.

11.)You are at the leading end of a canoe and your friend is at the trailing end as the canoe is drifting along at a speed of *v*. You toss a backpack to your friend and he catches it. What is the canoe's speed after your friend catches the backpack compared to before you threw it? Ignore any friction effects between the canoe and the water.

a. It is greater than *v*.
b. It is less than *v*.
c. It now has the same speed it had before the backpack was thrown.
d. We cannot tell from the information given.

12.) Two objects collide on a frictionless surface. If one had been at rest before the collision, is it possible for:

(i) one object to be at rest after the collision?

(ii) both objects to be at rest after the collision?

a. (i) only.
b. (ii) only.
c. Both (i) and (ii).
d. Neither (i) nor (ii).

13.) You have a piece of clay and a superball, both of the same mass. You want to close a door on the other side of the room by throwing either the clay or the superball at the door. Assume that both would be thrown with the same speed and would impact the door at the same point on the door. With which would you be more likely to cause the door to close further?

a. the superball.
b. the clay ball.
c. Both would cause the door to close the same distance.
d. It is impossible to tell.

14.)A pole-vaulter falls from a height of about 6.0 meters onto a foam rubber pad. Can you calculate his speed just before he reaches the pad? Can you calculate the force exerted on him by the pad?

a. With the given information you can calculate his final speed and you can calculate the force that the pad exerts upon him.
b. With the given information you cannot calculate his final speed but you can calculate the force that the pad exerts upon him.
c. With the given information you can calculate his final speed but you cannot calculate the force that the pad exerts upon him.
d. With the given information, you cannot calculate either his final speed nor the force that the pad exerts upon him.

15.)Which of the following expressions relates the momentum, *p*, of an object of mass *m* to its kinetic energy, *KE*?

a. $p = 2m(KE)$
b. $p = \sqrt{2m(KE)}$
c. $p = \dfrac{2m}{(KE)^{1/2}}$
d. $p = 2m(KE)^{1/2}$

Solutions: d, b, c, c, d, b, b, c, c, a, c, a, a, c, b