Unit 7 Review

Name: KEY Period: ____ Date: _____

Although this is NOT a comprehensive review, these questions can help you begin your studies for the Unit 7 Exam. The answer key is attached, but please use wisdom when using it. Answer all of the problems before checking your answers.

1. Which of the following has the greatest momentum?
   a. a 4.0 kg bowling ball moving at 2.0 m/s = 8 $\frac{kgm}{s}$
   b. a 0.15 kg baseball moving at 10.0 m/s = 1.5 $\frac{kgm}{s}$
   c. a 1.6×10^3 kg car moving at 0.5 m/s = 800 $\frac{kgm}{s}$
   d. a 0.02 kg bullet moving at 950 m/s = 19 $\frac{kgm}{s}$

2. How does the momentum of an object change if the object's velocity doubles? Explain your answer.
   If the velocity doubles the momentum doubles - They are directly proportional

3. What are the units of momentum?
   kgm/s

4. Which of the following can determine the magnitude of the change in an object's momentum? (Impulse)
   a. mass and acceleration
   b. force and time interval
   c. force and distance
   d. acceleration and time interval

   $I = F \cdot t$

5. Which of the following is true of changes in momentum?
   a. A small force may produce a large change in momentum by acting over a short time interval.
   b. A small force may produce a large change in momentum by acting over a long distance.
   c. A large force may produce a small change in momentum by acting over a short time interval.
   d. A small force may produce a large change in momentum by acting on a very massive object.

6. Which of the following involves a change in momentum?
   a. A bowling ball rolls down the lane at constant speed.
   b. A car coasts down a hill at constant speed.
   c. A sky diver descends with terminal velocity.
   d. A spacecraft travels at constant speed while slowly losing mass.

   If the mass changes the momentum changes.

7. A batter hits a baseball back to the pitcher at the same speed as the pitch. Which of the following is true?
   a. The momentum of the ball is the same before and after the batter hits the ball. Direction!
   b. The magnitude of the ball's momentum is greater after the batter hits the ball.
   c. The magnitude of the ball's momentum is less after the batter hits the ball.
   d. The magnitude of the ball's momentum is the same before and after the batter hits the ball.

8. When two objects interact in an isolated system,
   a. the momentum of each object is conserved.
   b. the total momentum of the system is zero.
   c. the total momentum is conserved only if the objects move in opposite directions.
   d. the total momentum is always conserved.

9. Which of the following expresses the law of conservation of momentum?
   a. The total momentum of an isolated system is zero.
   b. The total momentum of any system always remains constant.
   c. Every object in an isolated system maintains a constant momentum.
   d. The total momentum of an isolated system remains constant regardless of the forces between the objects in the system.

10. A billiard ball hits another billiard ball that is initially at rest. The second ball moves as a result. Which of the following is true?
    a. The momentum of the first ball doesn't change.
    b. The momentum of the second ball doesn't change.
    c. The total momentum of the system increases.
    d. The momentum lost by the first ball is gained by the second ball.

11. A croquet ball moving at 2.0 m/s strikes another ball of equal mass. The first ball stops moving after the collision. What is the velocity of the second ball after the collision?
    a. −2.0 m/s
    b. 0 m/s
    c. 2.0 m/s
    d. 4.0 m/s

12. Two cars collide, lock bumpers, and move together after the collision. What kind of collision is this?
    a. elastic collision
    b. inelastic collision
    c. perfectly elastic collision
    d. perfectly inelastic collision

13. In what kind of collision is kinetic energy always conserved?
    a. elastic collision
    b. inelastic collision
    c. perfectly inelastic collision

14. When an inelastic material is in a collision,
    a. the work done to deform the material is equal to the work done to return the material to its original shape.
    b. the work done to deform the material is equal to the work the material does to other objects in the collision.
    c. the work done to deform the material is equal to the increase in the system's total kinetic energy.
    d. some of the work done to deform the material is converted to other forms of energy.

15. A helium atom collides with another helium atom in an elastic collision. Which of the following is true?
    a. Both momentum and kinetic energy are conserved.
    b. Momentum is conserved but kinetic energy is not conserved.
    c. Kinetic energy is conserved but momentum is not conserved.
    d. Neither momentum nor kinetic energy is conserved.

16. Two playground balls collide in an inelastic collision. Which of the following is true?
    a. Both momentum and kinetic energy are conserved.
    b. Momentum is conserved, but kinetic energy is not conserved.
    c. Kinetic energy is conserved, but momentum is not conserved.
    d. Neither momentum nor kinetic energy is conserved.

17. Which of the following is *not* evidence that kinetic energy has been lost in a collision?
    a. The collision produces a sound.
    b. At least one of the objects is deformed after the collision.
    c. At least one of the objects increases in temperature as a result of the collision.
    d. One of the objects is at rest after the collision.

1)

$P_i = P_f$

$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$

Since $m_1 = m_2$ all masses cancel

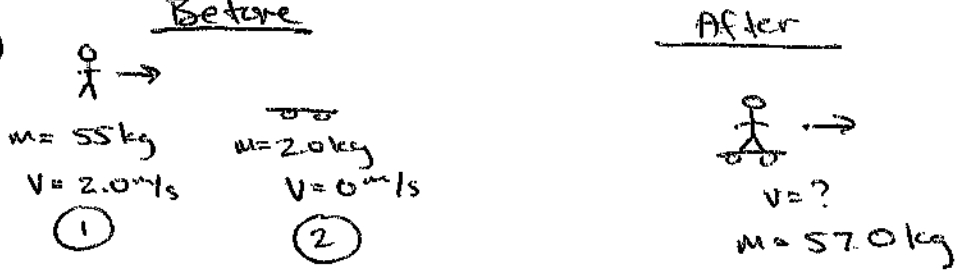
$v_{1i} + v_{2i} = v_{1f} + v_{2f}$

$v_{1i} + v_{2i} - v_{1f} = v_{2f}$

$1.2\ m/s + (-0.85\ m/s) - (-0.54\ m/s) = v_{2f}$

$v_{2f} = 0.89\ m/s$ Right

2.)



$P_i = P_f$

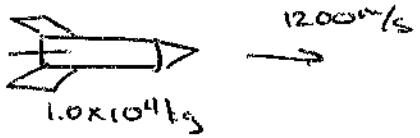
$m_1v_{1i} + m_2v_{2i} = m_c v_{cf}$ ($m_2v_{2i} = 0$)

$\frac{m_1v_{1i}}{m_c} = v_{cf}$

$v_{cf} = \frac{(55\ kg)(2.0\ m/s)}{57.0\ kg}$

$v_{cf} = 1.93\ m/s$ Right

3.)



$t = 2.0\ min = 120\ sec$

$F = 25\ kN = -2.5 \times 10^4\ N$

$\Delta p = F \cdot t$

$mv_f - mv_i = F \cdot t$

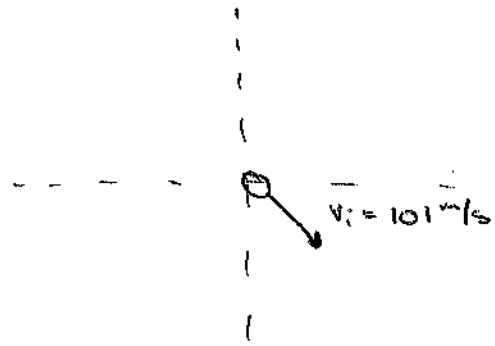
$\frac{mv_f}{m} = \frac{F \cdot t + mv_i}{m}$

$v_f = \frac{F \cdot t + mv_i}{m}$

$v_f = \frac{(-2.5 \times 10^4\ N)(120\ s) + (1.0 \times 10^4\ kg)(1200\ m/s)}{1.0 \times 10^4\ kg}$

$v_f = 900\ m/s$ Right

4)



$$\Delta p = F \cdot t$$

$$\frac{mv_f - mv_i}{F} = \frac{F \cdot t}{F}$$

$$t = \frac{mv_f - mv_i}{F} = \frac{m(v_f - v_i)}{F}$$

$v_f = 197\ m/s$

$F = 4.00 \times 10^5\ N$

$$t = \frac{1.24 \times 10^5\ kg\,(197 - 101\ m/s)}{4.00 \times 10^5\ N}$$

$$t = 29.8\ s$$

5)

$$v_i = \frac{\Delta x}{t} = \frac{861.0\ km}{22.67\ h} = 38.0\ \frac{km}{h} \times \frac{1000\ m}{1\ km} \times \frac{1\ h}{3600\ s} = 10.6\ m/s$$

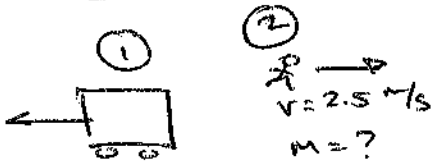
$$\frac{P}{V} = \frac{mv}{V}$$

$$m = \frac{P}{V} = \frac{7.32 \times 10^6\ \frac{kg \cdot m}{s}}{10.6\ m/s} = 6.91 \times 10^7\ kg$$

6)

Before

After



$v = -0.05\ m/s$

$m = 3.3 \times 10^3\ kg$

$$P_i = P_f$$

$$P_{cf} = P_{1f} + P_{2f}$$

$$m_c v_{ci} = m_1 v_{1f} + m_2 v_{2f}$$

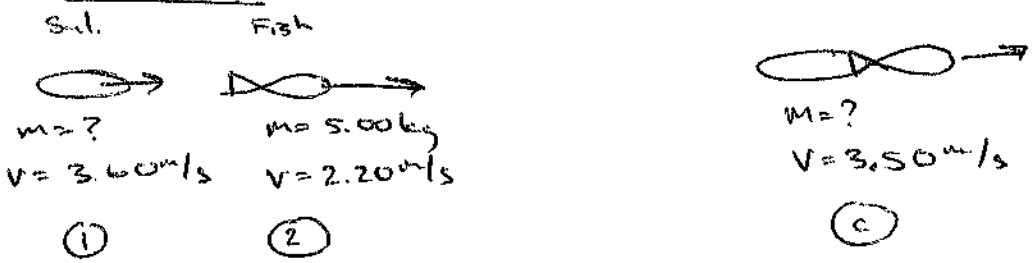
$$\frac{m_1 v_{1f}}{-v_{2f}} = \frac{-m_2 v_{2f}}{v_{2f}}$$

$$m_2 = \frac{-m_1 v_{1f}}{v_{2f}}$$

$$m_2 = \frac{-(3.3 \times 10^3\ kg)(-0.05\ m/s)}{2.5\ m/s}$$

$$m_2 = 66\ kg \quad \text{or} \quad 66.0\ kg$$

7)



$$P_i = P_f$$

$$m_1 v_{1i} + m_2 v_{2i} = m_c v_{cf} \qquad m_c = (m_1 + m_2)$$

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_{cf}$$

$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{cf} + m_2 v_{cf}$$

$$m_1 v_{1i} - m_1 v_{cf} = m_2 v_{cf} - m_2 v_{2i}$$

Factor out m_1

$$\frac{m_1 (v_{1i} - v_{cf})}{v_{1i} - v_{cf}} = \frac{m_2 v_{cf} - m_2 v_{2i}}{v_{1i} - v_{cf}}$$

$$m_1 = \frac{m_2 v_{cf} - m_2 v_{2i}}{v_{1i} - v_{cf}}$$

$$m_1 = \frac{(5.00\ kg)(3.50\ m/s) - (5.00\ kg)(2.20\ m/s)}{3.60\ m/s - 3.50\ m/s}$$

$$m_1 = 65\ kg$$

$$m_1 = 65.0\ kg$$