Conservation of Momentum Worksheet Name: Key

1. High-speed stroboscopic photographs show that the 0.200-kg head of a golf club is traveling at 55 m/s just before it strikes a 0.046-kg golf ball at rest on a tee. After the collision, the club head travels (in the same direction) at 40 m/s.
   a. What type of collision is represented above? How do you know? Elastic 2→2
   b. Why does the speed of the club drop after striking the ball? Explain using conservation of momentum.
   c. What is the final speed of the golf ball? Show your work:

$(.200\,kg)(55\,m/s) + (.046kg)(0\,m/s) = (.200)(40) + (.046)(v_f)$ P is transferred from club to the ball.

$+65\,m/s = v_f$

2. A 95-kg fullback, running at 8.2 m/s, collides in midair with a 128-kg defensive tackle moving in the opposite direction. Both players end up with zero speed.
   a. What type of collision is this? How do you know? Inelastic 2→1
   b. Before the collision, was the speed of the 128-defensive tackle greater than or less than that of the 95-kg fullback? (no math needed, think of what would need to be true about the momentums of each player before the collision to cause both to come to rest following the collision) Less than the FB
   c. What was the speed of the 128-kg defensive tackle prior to the collision? (show your work)

$(95\,kg)(8.2\,m/s) + (128\,kg)(v_i) = (95+128)\,0$

$-6.1\,m/s = 0$

3. A glass ball, ball A, of mass 5.0 kg, moves at a velocity of 20. m/s. It collides with a second glass ball, ball B, of mass 10.0 kg, moving along the same line with a velocity of 10. m/s. After the collision, ball A is still moving in the same direction, but with a velocity of 8 m/s.
   a. What type of collision is this? How do you know? Elastic 2→2
   b. What is ball B's speed after the collision?

$(5\,kg)(20\,m/s) + (10kg)(10\,m/s) = (5kg)(8\,m/s) + (10kg)\,v_f$ $v_f = +16\,m/s$

4. A rifle with a weight of 20.0 kg fires a 0.5 kg bullet with a speed of 30. m / s.
   a. What type of collision is this? How do you know? Sep 1→2
   b. What direction does the rifle move after firing the bullet? Why? – Cons of p
   c. What speed does the rifle move at after the collision? Show work.
   d. Suppose the mass of the rifle is doubled. Would the recoil speed of the rifle increase, decrease or remain constant? Why? more mass

$(20kg + 0.5kg)\,0 = (20kg)\,v_f + (.5kg)(30\,m/s)$ $v_f = -.75\,m/s$

5. A 75-kg man stands in the middle of a frozen pond. He is unable to walk to the other side because a lack of friction between his shoes and the ice. To overcome this difficulty, he throws his 1.2 kg physics textbook horizontally toward the north shore at a speed of 5.00 m/s.
   a. What type of collision is this? How do you know? Sep 2→1
   b. What happens to the man after throwing the textbook? Why? He slides back. Cons of p.
   c. Image the textbook had a mass of 75-kg and the man has a mass of 75-kg. How would the speeds of the textbook and man compare after the textbook being thrown? Why?

Same speed in opposite directions. Same force is applied to both objects. Since they are the same mass they would have = velocities.

6. A 60.0 kg astronaut is on a space walk away from the shuttle when her tether line breaks! She is able to throw her 10.0 kg oxygen tank away from the shuttle with a velocity of 14.0 m/s to propel herself back to the shuttle. Assuming that she starts from rest,
   a. Should the astronaut throw the oxygen tank towards the space shuttle or away from the shuttle? Why?
   b. After throwing the tank, will the astronaut be moving faster or slower than the bottle? Why?

Away so he will move back towards the shuttle. The astronaut and tank have 0 momentum before the collision. When the tank is thrown, it now has (+) momentum. The astronaut must have (–) momentum to conserve the initial

6. Slower because the astronauts has more mass than the tank and the same force was applied to both objects because of Newton's 3rd Law.