UCONN Physics 1201Q: Unit 7 **Name: _____**
Momentum and Collisions Date: _____ Period: ____
Worksheet III **/ 66**

Read each problem carefully. Be sure to use the correct equation(s). Show all of your work. Be sure to circle and label final answers. Use Separate paper to attach to this sheet with answers. 3 pts. each

1. A ball of mass 0.440 kg moving with a speed of 4.5 m/s collides head-on with a 0.220 kg ball at rest. If the collision is elastic, what will be the speed of each ball after the collision? [6 m/s, 1.5 m/s]

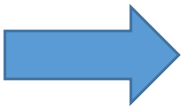
2. A 4 kg ball with a velocity of 4 m/s in the positive x-direction has a head-on elastic collision with a stationary 2 Kg ball. What are the velocities of the balls after the collision?[5.33 m/s, 1.33 m/s]

3. A ball with a mass of 100 g is traveling with a velocity of 50 cm/s in the positive x-direction and collides head-on with a 5 Kg ball that was at rest. Assuming that it is elastic, find the velocities (in m/s) of the balls after the collision.
[0.01961 m/s , -0.48 m/s]

4. A 100 g bullet is fired horizontally into a 14.9 kg block of wood resting on a horizontal surface, and the bullet becomes embedded in the block. If the muzzle velocity of the bullet is 250 m/s, what is the velocity of the block containing the embedded bullet immediately after impact? (Neglect surface friction) [1.67 m/s]

5. A 90 kg astronaut Travis is stranded in space at a point 12 m from his spaceship. In order to get back to his ship, Travis throws a 0.50 kg piece of equipment so that it moves at a speed of 4 m/s directly away from the spaceship. How long will it take him to reach the ship? [540 sec or 9 min]

6. A 0.300 kg ball, moving with a speed of 2.5 m/s, has a head-on collision with at 0.600 kg ball initially at rest. Assuming a perfectly elastic collision, what will be the velocity of each ball after the collision? [1.667m/s , -0.833 m/s]



7. Two billiard balls of equal mass undergo a perfectly elastic head-on collision. If the speed of one ball was initially 2 m/s, and the other was 3 m/s in the opposite direction, what will be their speeds after the collision? [2 m/s , -3 m/s]

8. A 2.5 kg block sliding on a frictionless horizontal surface with a constant velocity of 6 m/s approaches a stationary 6.5 kg block. If the blocks have a completely inelastic collision, what is their velocity after the collision? [1.67 m/s]

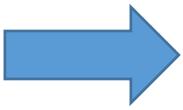
9. Block A with mass 12 kg moving 2.4 m/s makes an elastic head-on collision with block B, mass 36 kg, which is at rest. Find the velocities of the two blocks after the collision. [1.2 m/s, -1.2 m/s]

10. Darcy who has a mass of 65 kg is ice skating and traveling at 4 m/s to the north. Traveling in the opposite direction of Adele, Darcy suddenly grabs the hand of Adele, who has a mass of 56 kg and is traveling at 12 m/s. While holding hands, the two girls continue skating together with joined hands. What is the final velocity of the two skaters?[-3.4 m/s]

11. Brett, who has a mass of 76 kg and is initially at rest in a stationary 45 kg boat, steps out of the boat and onto a dock. If the boater, Brett, moves out of the boat with a velocity of 2.5 m/s to the right, what is the velocity of the boat?[4.22 m/s]

12. A 2,250 kg car is slowed down uniformly from 20 m/s to 5 m/s in 4 seconds. What is the constant force acting on the car during this time? [8,437.5 N]

13. You are sitting at a LCHS baseball game when Brent hits a foul ball that comes your way. Not having a glove, you prepare to catch Brent's foul ball barehanded. In order to catch it safely, should you move your hands toward the ball, hold them still, or move them in the same direction as the moving ball? Explain using the concept of change of momentum and impulse. Be sure to use complete sentences.[Own answer]



14. Jayme, who has a mass of 40 kg, is ice-skating and traveling at 4 m/s to the north towards Anthony, who has a mass of 65 kg and is traveling South at 12 m/s towards Jayme. As the two approach each other, Jayme suddenly grabs the arm of Anthony. While holding his arm, the two continue skating together. What is the final velocity of Jayme and Anthony skating together? [-5.9 m/s]

15. Ashleigh and August dock a paddle boat. Ashleigh, who has a mass of 50 kg, moves forward at 3.8 m/s as she leaves the boat. At what speed and in what direction do the paddle boat and August move if their combined mass is 105 kg? [1.81 m/s]

16. A 23 g bullet traveling 230 m/s penetrates a 2.0 kg block of wood and emerges cleanly at 170 m/s. If the block is stationary on a frictionless surface when hit, how fast does it move after the bullet emerges? [0.69 m/s]

17. A 50 g tennis ball travels at a velocity of 15 m/s, hits a basketball with a mass of 600 g that is stationary on a frictionless surface and then rebounds back in the opposite direction with a velocity of -6 m/s . How fast will the basketball be moving after the collision?[1.75 m/s]

PART II: Answer the following questions. 3 pts. each

18. Write the equation for momentum and its units. [check formula]

19. Can a bullet and a truck have the same momentum? Explain. [Own words]

20. Considering impulse, why are cars made with bumpers that can be pushed during a crash? [check formula]

21. When you ride a bicycle at full speed and the bike stops suddenly, why do you have to push hard on the handlebars to keep from flying off? [Own answer]

22. Why do you tend to lean backward when carrying a heavy load in your arms? [think center of mass (gravity)]