Unit 7 Worksheet – Momentum pre-AP!

Name_____

Vocabulary/Questions:

Impulse Momentum Conservation of momentum
Elastic Inelastic

1. What is meant by momentum being conserved?
2. The sum of the momentums of the particles after an explosion are (greater than/less than/equal to) the sum before the explosion.
3. Are cars designed to collide elastically or inelastically? Why?
4. In a collision, what is conserved: Mass, Velocity, momentum, direction.
5. Why do drivers of semis almost never get hurt in collisions?
6. You're trapped in space. How can you move, if all you have is a hammer?
7. Can a bullet and a truck have the same momentum? Explain.

Problems:

A. Impulse/basic momentum

1. A .65 kg baseball is thrown toward the batter at 32.3 m/s. The batter hits the ball back toward the pitcher at a rate of 45.2 m/s. (a) What was the momentum of the ball before he hit it? (b) what is the momentum after? (c) If the bat and ball were in contact for .598 seconds, how much force did the batter apply? (d) How much force did the bat get from the ball? (e) If the bat's mass was 1.98 kg, how much of a velocity change did it have?
2. Two rams are fighting. Ram A has a mass of 52.9 kg and is running at 15.9 m/s. Ram B has a mass of 65.8 kg and is moving at 13.7 m/s. They collide, butting heads. What was the momentum of each ram before the collision? Who shoved whom back?
3. Briana's 1500 kg car brakes from 32.8 m/s to a stop with a force of 379 N. How much time did it take?

1) 21 Ns, -29 Ns, -84 N, 84 N, 25 m/s
2) 841 Ns, 901 Ns, Ram B won
3) 130 Sec

B. Collisions in 1 dimension

1. Kristen fires a rifle that shoots a .0059 kg bullet at 2876 m/s. The gun's mass is 3.63 kg. How fast does the gun move? If her shoulder stops the gun in .872 secs, how much force is applied to her shoulder?
2. A large gun on a destroyer projects a bullet of mass 909 kg at a 629 m/s velocity. If the cannon's mass is 1895 kg, how fast does it recoil?
3. Tammye's bumper car has a mass of 52.9 kg and is moving at 15.9 m/s. Emmanuel's has a mass of 65.8 kg and is moving at 13.7 m/s. They collide head-on. What are their velocities?
4. Connor is trying to pick up her spare in bowling. Her 5.45 kg ball rolls toward the pin at 12.5 m/s. After hitting the lone pin, the ball slows to what speed? How fast is the .909 kg pin moving?
5. Carlos is driving behind Destinee. His 1525 kg car is traveling at 27.8 m/s, while her 1298 kg car is only going 26.4 m/s. He bumps into her. How fast are they now each traveling?
6. Aaron knocks the eight ball in to win the pool match. The .227 kg cue ball was traveling at 12.8 m/s before it hit. How fast are they both going if the 8-ball's mass is .295 kg?

1) -4.7 m/s, 19 N
2) 302 m/s the other way
3)T 16.9 m/s, E 12.7 m/s, both backwards
4) B 8.93 m/s, P 21.4 m/s, both forward
5) C 26.5 m/s, D 27.9 m/s, both forward
6) c -1.67 m/s, 8=11.1 m/s
7) 1.08 m/s in Rudolph's original direction
8) 42.0 m/s
9) 15.7 m/s forward

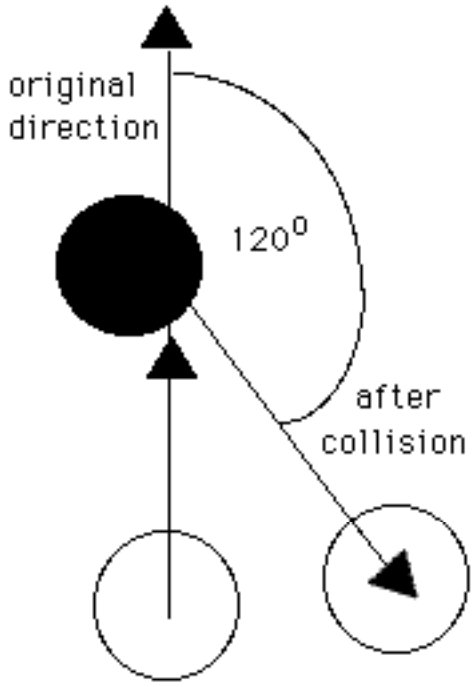
(Pbs B continued on back.....)

7. Two bucks are fighting over a doe. Rudolph (mass 125 kg) travels at 17.3 m/s toward Bambi who has a 100.0 kg mass and is moving 19.2 m/s. They lock horns and stick together. What is their new velocity?
8. A semi (mass 22 727 kg) traveling at 45.5 m/s collides head on with Jeffrey's car traveling at the same speed. The car's mass is only 908 kg, and it becomes permanently entangled in the grill of the semi. What is the new velocity of the wreckage?
9. Kianna (mass 40.9 kg) is skating at a speed of 14.3 m/s when Neto skates up behind her and grabs her. His speed was 16.5 m/s, and his mass is 68.2 kg. If they stay together, what is their new speed?

C. Collisions in 2 dimensions

1. Victor, alias superman, gets hit in the chest with a 301 kg bullet traveling at 297 m/s. Naturally, it just bounces off his chest of steel, going 161 m/s at a 42^{o} angle to the left. If Victor's mass is 62.0 kg, how fast, at what angle, is he now traveling?

2. A 7.25 kg bowling ball is rolling at 3.47 m/s toward a pin of mass 1.13 kg. The pin is deflected 39^{o} to the right at 7.11 m/s. What is the velocity and direction of the ball?



3. A 69.3 kg boat floats at 14.3 m/s toward a 28.3 kg buoy in the water. The buoy is sent off 28^{o} to the right at 22.4 m/s. What is the new speed and direction of the boat?

4. A 8.42 kg bowling ball rolls at 4.29 m/s toward a stationary 1.09 kg basketball. the bowling ball slows to 3.72 m/s and goes 15^{o} to the left. What is the speed and angle of the basketball?

5. A white frictionless puck of mass 1.25 kg is traveling toward a stationary black frictionless puck of mass 5.28 kg at 48.3 cm/s. They collide off-center, with the white puck bouncing back at a 120 degree angle to the right at a 12.8 cm/s velocity. What is the new velocity (with angle) of the black puck?

1) 1010 m/s, 31^{o} right
2) 2.70 m/s, 15^{o} to the left
3) 7.56 m/s, 35^{o} left
4) 9.18 m/s, 54^{o} right
5) 13.2 cm/s, 12^{o} to the left