STANDARDS: HS.P.M.48 _____ HS.P.M.49 _____ HS.P.M.51_____ HS.P.M.52_____

HS.P.M.54 _____ HS.P.M.56_____

Name: Answer Key Period: _____ Date: _____

HS.P.M.48, 49, 51, 52, 54, 56 Assessment

HS.P.M.48	I can calculate the momentum of and the impulse on an object (or system) with direction and proper units.	
HS.P.M.51	I treat momentum as a vector quantity	

1. A 1500 kg race car starts at rest at the starting line and accelerates eastwards to a final velocity of 27 m/s in 3.5 seconds.

   a. What is the initial momentum of the race car?

   $p = mv$

   $p = (1500)(0)$

   $p = 0$ Poms

   b. What is the final momentum of the race car?

   $p = mv$

   $p = (1500)(27)$

   $p = 40500$ Poms Eastward

   c. What is the force acting on the car to cause the change in velocity?

   $J = \Delta p$

   $J = p_2 - p_1$

   $J = 40500 - 0$

   $J = 40500$ Poms

   $J = Ft$

   $\frac{40500}{3.5} = \frac{F(3.5)}{3.5}$

   $11571.4\ N = F$

HS.P.M.49	Know the difference between momentum and velocity and which is conserved in a collision.	

2. What is the definition of momentum?

- a quantity of motion
- mass times velocity

3. What is the definition of velocity?

- speed with direction
- distance over time

4. In a collision, which one is conserved: velocity or momentum? momentum

HS.P.M.54	I can determine whether or not a collision was elastic by analyzing the motion information	

5. Based on the data table, determine if the following situation is an elastic or inelastic collision.

m_1	m_2	v_{i1}	v_{i2}	v_{f1}	v_{f2}
1400 kg	1200 kg	14 m/s	-12 m/s	-10 m/s	16 m/s

The collision is elastic

Why? the two masses have different final velocities thus they cannot be moving together after the collision

HS.P.M.52	I can explain a situation in words using momentum concepts.	

6. Describe a real world/sports situation that uses momentum concepts.
   Use the terms force, time, impulse, momentum and velocity in your answer.

- riding a punch in boxing
- pool balls colliding on a pool table
- padding in football helmets
- pads underneath a basketball hoop
- crash pad below high jump / pole vault bar
- air bag in car
- crumple zone in car
- styrofoam packing in packages

HS.P.M.56	I can solve a problem involving a collision or explosion by employing two fundamental principles.	

7. Two bumper cars head towards each other and experience an **elastic collision**. Car 1 has a mass of 1200 kg and Car 2 has a mass of 600 kg. Car 1 has an initial velocity 3 m/s and Car 2 had an initial velocity of -3 m/s. Car 2 had a final velocity of 5 m/s. What is the final velocity of Car 1?

$$m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2}$$

$$(1200)(3) + (600)(-3) = (1200)v_{f_1} + (600)(5)$$

$$3600 + (-1800) = 1200v_{f_1} + 3000$$

$$1800 = 1200v_{f_1} + 3000$$

$$-3000 \qquad -3000$$

$$\frac{-1200}{1200} = \frac{1200v_{f_1}}{1200}$$

$$\boxed{-1\ m/s = v_{f_1}}$$

8. Two bumper cars head towards each other and experience an **inelastic collision**. Car 1 has a mass of 1200 kg and Car 2 has a mass of 600 kg. Car 1 has an initial velocity 3 m/s and Car 2 had an initial velocity of -3 m/s. What is the final velocity of two cars stuck together?

$$m_1v_{i1} + m_2v_{i2} = (m_1 + m_2)v_f$$

$$(1200)(3) + (600)(-3) = (1200 + 600)v_f$$

$$3600 + (-1800) = 1800v_f$$

$$1800 = 1800v_f$$

$$\boxed{1\ m/s = v_f}$$