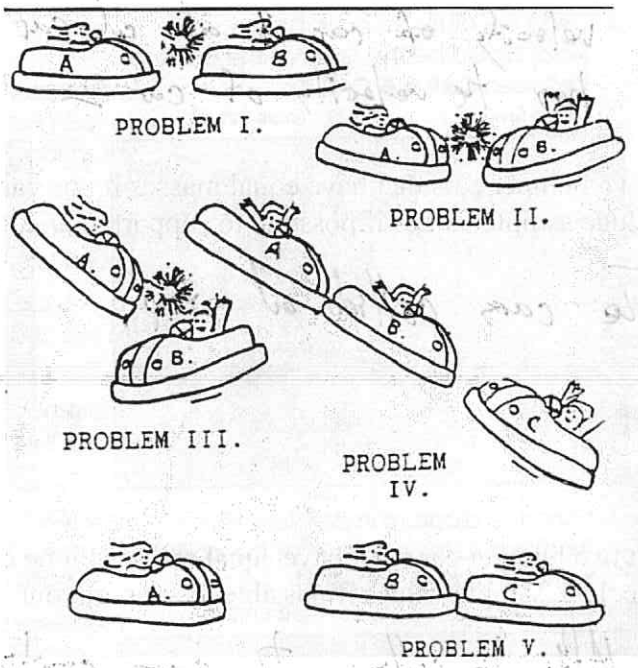
Name: Solutions Period: ALL Date: _____

Amusement Park Physics- Momentum Bumper cars

he following exercise involves bumper cars at an amusement park. Use formulas for momentum to assist in answering the following questions.

INSTRUCTIONS: You will work with a lab partner on the Physics Day Pre Lab Bumper Cars. Each person in the group will keep individual records. All the information collected and calculated will be reviewed next class.

Bumper Cars: COYOTE CREEK CRAZY CARS



USE THE DIAGRAMS ON THIS PAGE TO ANSWER THE FOLLOWING QUESTIONS ON THE NEXT PAGE:

Mass of bumper car = 200 Kg Maximum Car Speed = 1.7 m/s Assume Rider Mass = 65 kg

PROCEDURE

1. Define momentum. mass × velocity = momentum

   $p = mv$

2. Define the Law of Conservation of Momentum.

   The momentum at the beginning of an event is equal to the momentum at the end of the event. $P_{Before} = P_{After}$

3. Calculate the momentum of one car traveling at maximum speed (Remember to add the rider's mass to the mass of the car).

   Mass car = 200 kg
   Mass rider = 65 kg
   Mass Total = 265 kg

   $v = 1.7 \frac{m}{s}$

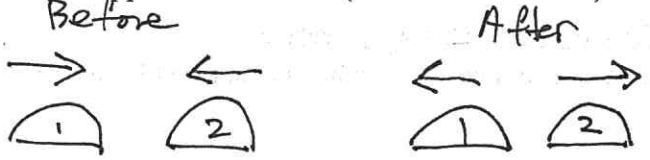
   $p = ?$

   $p = mv$

   $p = (265\ kg)(1.7 \frac{m}{s})$

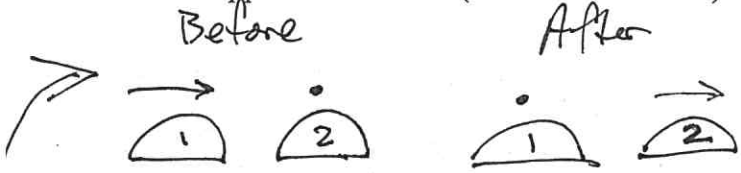
   $p = 450.5\ kgm$

4. Explain the outcome of an elastic collision between two bumper cars that have equal masses and equal but opposite velocities (a head on collision). Include sample values if possible to support your answer.



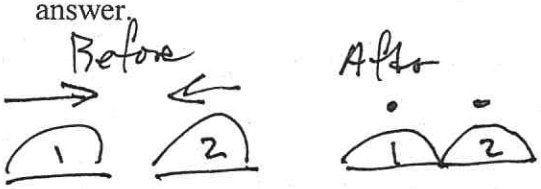
Cars bounce off of each other with the same velocity magnitude, but opposite sign

#6 Explain the outcome of an inelastic collision between two bumper cars that have equal masses and equal but opposite velocities (a head on collision). Include sample values if possible to support your answer.



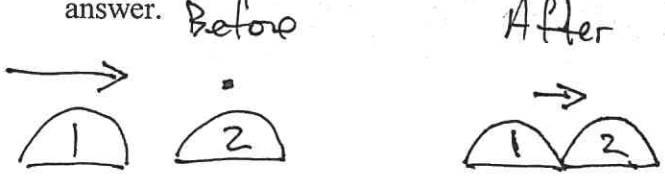
After the collision car 2 has the velocity of car 1 and car 1 has the velocity of car 2

#5 Explain the outcome of an elastic collision between two bumper cars that have equal masses if one car is at rest and the other car has a velocity of 1.7 m/s. Include sample values if possible to support your answer.



The cars collide and stop.

7. Explain the outcome of an inelastic collision between two bumper cars that have equal masses if one car is at rest and the other car has a velocity of 1.7 m/s. Include sample values if possible to support your answer.



After the collision the cars continue moving in the direction of car 1's velocity but the velocity is only $\frac{1}{2}$ of the original velocity.

8. Calculate the final velocity for bumber car #2 in the following elastic collision: Bumber car #1 has two passengers, an initial velocity of 1.7 m/s, and a final velocity of 0.185m/s. Car #2 has 1 passenger and is initially at rest.

$m_{car\#1} = 200 + 65 + 65 = 330\,kg$

$m_{car2} = 265\,kg$

$V_{car\#1_I} = 1.7\,m/s$

$V_{car\#1_F} = 0.185\,\frac{m}{s}$

$V_{car\#2_I} = 0\,\frac{m}{s}$

$m_1V_1 + m_2V_2 = m_1V_{1F} + m_2V_{2F}$

$(330\,kg)(1.7\,\frac{m}{s}) + (265\,kg)(0\,\frac{m}{s}) = (330\,kg)(0.185\,\frac{m}{s}) + (265\,kg)V_{2F}$

$561 + 0 = 61.05 + (265\,kg)V_{2F}$

$\frac{499.9}{265} = \frac{(265\,kg)V_{2F}}{265}$

$V_{2F} = 1.87\,\frac{m}{s}$