

### Momentum Lab (computer simulation)

**Purpose** - to illustrate the differences between elastic, inelastic, semi-elastic collisions, and to verify the Law of Conservation of Momentum.

**Procedure** -

- 1.) Open the Interactive Physics Player (IP Player sim 22) program by double clicking on start/applications/science applications/IP Player, then file open, double clicking on sim22
- 2.) Enlarge to full screen.
- 3.) Note the mass of each car is 2000 kg.
- 4.) Change the output from graphs to a numbered meter by clicking twice on the arrow on the graph.
- 5.) Change the red car's initial velocity to zero, change the elasticity to completely elastic.
- 6.) Copy the table below into your report:

<b>Elasticity</b>	$\vec{p}_{\text{(blue)}}$ <b>before</b>	$\vec{p}_{\text{(red)}}$ <b>before</b>	$\vec{p}_{\text{(total)}}$ <b>before</b>	$\vec{p}_{\text{(blue)}}$ <b>after</b>	$\vec{p}_{\text{(red)}}$ <b>after</b>	$\vec{p}_{\text{(total)}}$ <b>after</b>
Elastic						
Inelastic						
Semi-elastic	<b>Example Only</b>					
Semi-elastic						
Inelastic						
Elastic						

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- 7.) Run the experiment and record the data in your table.
- 8.) Reset and change to completely inelastic, run and record the data in the table.
- 9.) Reset and change to semi-elastic, run and record the data in the table.
- 10.) Reset and change to the red car's initial velocity to  $-3.5 \frac{m}{s}$ , run and record the data in the table.
- 11.) Reset and change to completely inelastic, run and record the data in the table.
- 12.) Reset and change to completely elastic, run and record the data in the table.
- 13.) Close IP Player and open Interactive Physics 2000 using the same procedure as in Step 1.
- 14.) Choose file/open select I: drive/Handout/science/Wilkison/phys 11/2-D\_Momentum 2.ip
- 15.) Copy the table below into your report

	<u>Bullet</u> <u>before</u>	<u>Head</u> <u>before</u>	<u>Body</u> <u>before</u>	<u>Total</u> <u>before</u>	<u>Bullet</u> <u>after</u>	<u>Head</u> <u>after</u>	<u>Body</u> <u>after</u>	<u>Total</u> <u>after</u>
X momentum								
Y momentum								

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Example Only

- 16.) Run the sim and stop before the masses collide, fill in the appropriate data on your table.
- 17.) Run the sim until the masses collide, stop and record the appropriate data in your table.
- 18.) Close Interactive Physics 2000.
- 19.) Record the X and Y momentum of each object before collision, then the total momentum of each object in the X and Y directions after the collision.

Discussion -

- 1.) Is the Law of conservation of momentum violated in any example? Explain. (2)
- 2.) Describe how the law of conservation of momentum applies in 2 dimensions. (2)
- 3.) Play with the simulation until both cars come to a stop after the collision. Describe the momentum of each car and the elasticity for this to occur. (2)

Conclusion - describe the three types of collisions and state numerical proof from your experiment that demonstrates these collisions. As well, verify the law of conservation of momentum for both the 1-D and 2-D by stating examples from your experiment that support this law. (4)