

Collisions

Software

- VPython, Python and the graphical user interface (GUI) IDLE (or VIDLE)

Models are only as valid as the physics used to create them.

Objective

Gain experience writing VPython programs

- Create and use graphics windows to plot variables
- Continue to effectively search for help in tutorials and reference manuals

Create a collision simulation using the spring-model interaction of objects

- Model elastic collision
- Model inelastic collision

Clearly express assumptions and limits to model

Group

Investigate the simulation model for a cart interacting with a wall.

- Determine and calculate the minimum spring constant needed for two objects colliding. The idea is to find an expression for k as a function of momentum and mass of the objects and spring length.
- Modify the programs to use this equation. Test the program with different initial momentum and mass.
- Inelastic collisions lose kinetic energy. Describe what happens to this missing energy.
- **Write out the physics equations for each part of the code. Indicate where the momentum principle is being applied.**

NOTE: Use the “*Cart Wall Collide*” code for elastic collisions and the “*Cart Wall Smash*” code for inelastic collisions

Individual

Test conservation of momentum in a two cart system. You are encouraged to work with another student (or two) but you need to make sure you understand the program.

Modify the simulations above so the wall is a cart and can move.

- Add appropriate code to set the initial conditions of the second cart.
- Determine the direction and magnitude of the force on the second cart (the wall).
- Add appropriate code to move the second cart.
 - Use the momentum principle
 - Use an equation of motion to update the position
- Add additional code to plot both the momentum and energy of the second cart.

Examine the momentum and energy graphs.

- Determine if momentum is conserved.
- Determine if kinetic energy is conserved.
- Determine if total energy is conserved.

1. [10.X.14] What happens to the velocities of the two objects when a high-mass object hits a low-mass object head-on? When a low-mass object hits a high-mass object head-on?