

## Newton's Third

**Purpose:** To investigate Newton's third law and the effects of action/reaction pairs.

**Set-up:** Attach two force probes to your SPARK interface and connect it to the computer. Create a new experiment in Capstone and set-up a force vs. time graph. Have the data for both force sensors show up on the same graph. Display one sensor with pull positive, the other with push positive, so they show up on opposite sides of the graph.

READ THROUGH THIS FIRST AND THEN BEGIN WORKING!!!

**Activity:** Use a doubled-up piece of string to connect the hooks on the two force probes; about 1m should be long enough. "Zero" the force probes before beginning. Have two group members pull against one another while keeping the string tight. **Your third group member should hold the SPARK interface in his or her hand to avoid it dropping on the floor.** Generate a force vs. time graph for this effort. Observe what happens when the force probes do not move, and also when they move between the two group members (always keeping the string tight!)

*Print the force vs. time graph for this effort and describe its meaning. Draw a system schema for the system made up of the two force probes, and draw free-body diagrams for each force probe. Discuss whether or not the force probes were moving; include evidence for how you know.*

Now have one group member sit in a chair that rolls on a white board and another stand, each with his/her own force probe. **Your third group member should hold the SPARK interface in his or her hand to avoid it dropping on the floor.** Set the chair in motion by pulling with the force probes; try it two different ways so that a different force probe remains stationary each time. Avoid reaching the force sensor's measurement limit. *How does the force measured by one probe compare to the force measured by the other? Explain what you have observed.*

Develop a novel situation as a group for which you can collect force data using both force probes. *Collect your force data and print the graph. Describe the situation in detail (much like the problems we have been working on during the past few class meetings). Provide free-body diagrams for each force sensor and explain why they are correct.*

\*\*\*Remember that lab reports are to be completed individually. Graphs will obviously be the same for each group member, however all questions/descriptions must reflect your own work (a group discussion will help to clarify your ideas, and help you put them into words). Any duplicate lab reports from within a group will receive NO CREDIT!