Homework 2

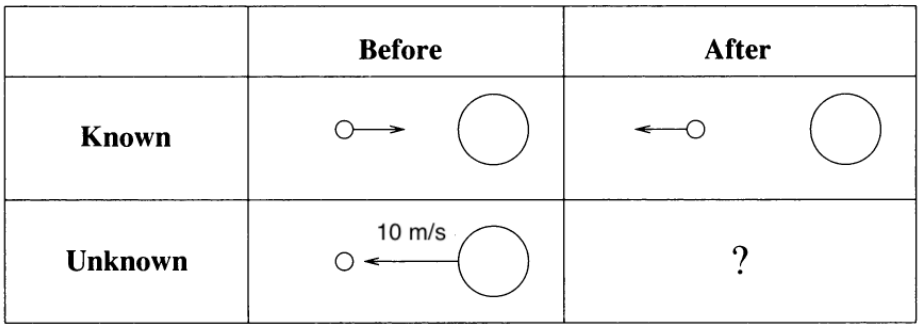
Due Tuesday, February 5th in class

Read Ch. 2 of Jespersen and Fitz-Randolph and Chs. 1 & 2 of Carlo Rovelli's "The Order of Time".

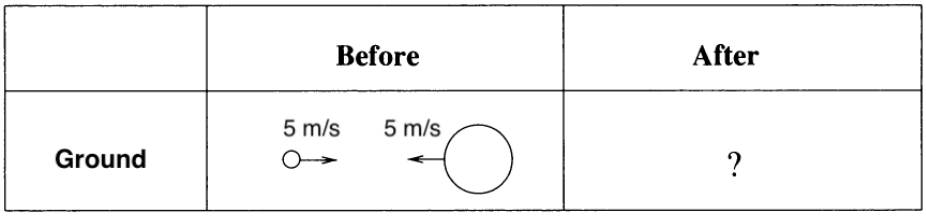
Questions to think about and answer: First, two questions about the principle of relativity that we discussed in class.

1. Suppose you throw a ping-pong ball at a stationary bowling ball. Neither is sticky, but the bowling ball is so much heavier that the ping-pong ball will bounce off at essentially the same speed that it came in at and the bowling ball won't move at all.

   Now suppose that you left the ping-pong ball at rest and threw the bowling ball at it with a speed of 10 m/s. Use the principle of relativity to determine how the two balls will move after the collision. This situation is summarized pictorially below. Give both numerical speeds for the two balls and draw their "After" motion, as in the final box.



2. As in the last problem, consider a ping-pong ball and a bowling ball. This time suppose that you throw them at each other in the ground frame and they each have a speed of 5 m/s. Choose a moving frame that makes the collision easy to analyze and analyze it in that frame. Returning to the ground frame what are the after picture and the final speeds of each ball?



3. Suppose that a train moves at a speed of 5 m/s with respect to the ground and that a child plays with his remote-controlled car in the train. If the child drives his car along the aisle in the same direction that the train is moving at a speed of 1 m/s, then: (a) What is the speed of the remote-controlled car with respect to the ground? (b) If the child turns on the car's headlights, what is the speed of the emerging light with respect to the car? (c) What is the speed of the light with respect to the train? and (d) What is the speed of the light with respect to the ground?