

"Conceptual Momentum w.s."

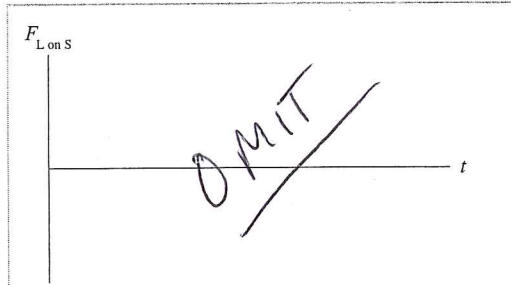
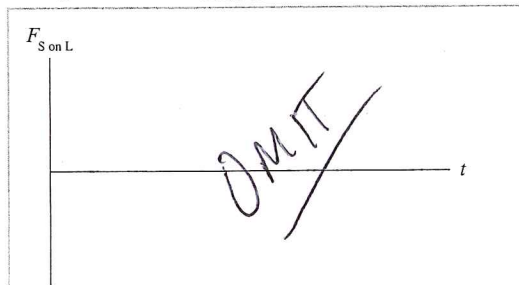
1. A small, light ball S and a large, heavy ball L move toward each other, collide, and bounce apart.



- a. Compare the force that S exerts on L to the force that L exerts on S. That is, is $F_{S \text{ on } L}$ larger, smaller, or equal to $F_{L \text{ on } S}$? Explain.

- b. Compare the time interval during which S experiences a force to the time interval during which L experiences a force. Are they equal, or is one longer than the other?

- c. Sketch a graph showing a plausible $F_{S \text{ on } L}$ as a function of time and another graph showing a plausible $F_{L \text{ on } S}$ as a function of time. Be sure think about the *sign* of each force.



- d. Compare the impulse delivered to S to the impulse delivered to L.

- e. Compare the momentum change of S to the momentum change of L.

- f. Compare the velocity change of S to the velocity change of L.

- g. What is the change in the *sum* of the momenta of the two balls? Is it positive, negative, or zero?

Exercises 8–11: Prepare a pictorial representation for these problems, but *do not* solve them.

*until we
whiteboard
them*

- Draw pictures of “before” and “after.”
- Define symbols relevant to the problem.
- List known information, and identify the desired unknown.

*Remember: Momentum is ---
Yes, CONSERVED!*

8. A 50 kg archer, standing on frictionless ice, shoots a 100 g arrow at a speed of 100 m/s. What is the recoil speed of the archer?

9. The parking brake on a 2000 kg Cadillac has failed, and it is rolling slowly, at 1 mph, toward a group of small innocent children. As you see the situation, you realize there is just time for you to drive your 1000 kg Volkswagen *head-on* into the Cadillac and thus save the children. With what speed should you impact the Cadillac to bring it to a halt?

10. Dan is gliding on his skateboard at 4 m/s. He suddenly jumps backward off the skateboard, kicking the skateboard forward at 8 m/s. How fast is Dan going as his feet hit the ground? Dan’s mass is 50 kg and the skateboard’s mass is 5 kg.