

Part A: Concepts

Answer in complete sentences.

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1. Liam fires a paintball gun while standing still on a skateboard. Explain, using momentum, why Liam rolls backward. Why does the paintball move much faster than Liam?

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2. Maya says a rocket cannot work in space because there is no air to push against. Is she right? Explain what the rocket really pushes on.

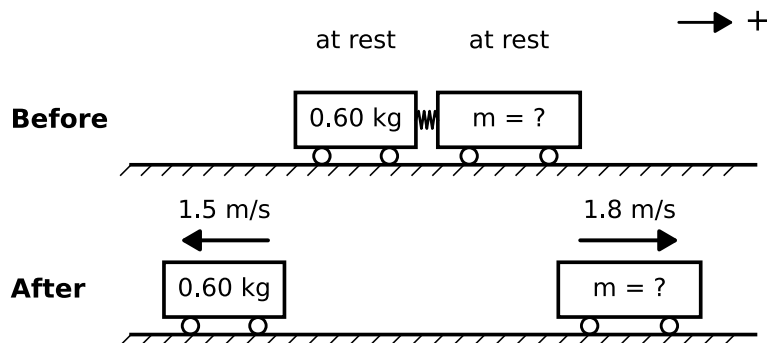
Part B: Calculations

Show knowns, equation, substitution, and answer with units. Right is positive.

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3. A 4.0 kg rifle at rest fires a 0.010 kg bullet to the right at 400 m/s. What is the recoil velocity of the rifle?

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4. A 78.0 kg hockey player and a 52.0 kg figure skater stand at rest on the ice and push off each other. The hockey player moves right at 1.20 m/s. What is the velocity of the figure skater?

5. A compressed spring between two carts is released, and the carts fly apart from rest, as shown. Find the mass of the second cart.



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6. Sofia (55.0 kg) sits at rest on a 5.0 kg sled on smooth ice. She throws a 3.0 kg ball to the right at 6.0 m/s.
- What is the velocity of Sofia and the sled after the throw?
 - If she threw the ball twice as fast, what would happen to her recoil velocity? Explain without redoing the whole problem.