

Work each of the following problems. SHOW ALL WORK.

1. Two people stand facing each other at a roller skating rink then push off each other.

a. What is the momentum of the system before they push off each other?

b. What must be the momentum of the system after they push off each other?

c. If the girl skater has a mass of 30 kg and moves backward at 5 m/s, what is the velocity of the boy skater if his mass is 50 kg?

d. If the force applied between the two skaters occurs over 2.5 seconds, what is the force exerted on each of the skaters?

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2. A 200 g blob of clay moves with a speed of 10 m/s towards a 300 g cart that is initially at rest.

a. What is the momentum of the system before the blob of clay strikes the cart?

b. What must be the momentum of the system after they come together?

c. If the blob of clay sticks to the cart, with what speed will the clay and cart move after they come together?

3. Two carts, each with a mass of 2.5 kg, move toward one another.

a. If the cart moving left is traveling at 10 m/s and the cart moving right is traveling at 8 m/s, what is the magnitude and direction of the total momentum of the system?

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b. What is the total momentum of the system if the two carts have the same speed?

4. An 800 kg car and a 1,600 kg truck move toward one another, both traveling at 15 m/s. In what direction will the two vehicles move after they collide? Show your calculations to prove your answer.

5. A woman stands in a boat at rest on a calm lake. She throws a 10 kg anchor off the front of the boat, which has a mass of 1,000 kg.

a. What is the initial momentum of the anchor-boat system?

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b. In which direction will the boat move after the anchor is thrown?

c. How does the change in momentum of the anchor compare to the change in momentum of the boat?

d. If the velocity of the anchor is 12 m/s, what is the velocity of the boat after the anchor is released?