Practice - Conservation of Momentum

Name: _____ **Date:** _____

1. When objects exert forces on each other, the total momentum of the system

   A. decreases B. increases

   C. remains the same

2. Refer to the diagram and information below for questions 2 through 4.

   The diagram shown represents two objects at rest on a frictionless horizontal surface with a spring compressed between them. When the compressed spring is released, the two objects are pushed apart.

   What is the total momentum of the two-object system that is shown after the expansion of the spring?

   A. 20 kg-m/s B. 10 kg-m/s

   C. 5.0 kg-m/s D. 0 kg-m/s

3. What is the velocity of the 2.0-kilogram object that is shown after being acted on by 10 newton-seconds of impulse?

   A. 1.0 m/s B. 2.0 m/s

   C. 5.0 m/s D. 10 m/s

4. If the 1.0-kilogram object that is shown receives an impulse of –20 newton-seconds, what impulses does the 2.0-kilogram object receive?

   A. 0 N-s B. +5.0 N-s

   C. +10 N-s D. +20 N-s

5. A 20-kilogram cart traveling east with a speed of 6 meters per second collides with a 30-kilogram cart traveling west. If both carts come to rest immediately after the collision, what was the speed of the westbound cart before the collision?

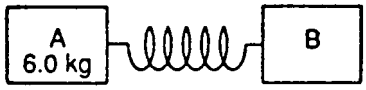
   A. 6 m/s B. 2 m/s C. 3 m/s D. 4 m/s

6. A 2.0-kilogram rifle initially at rest fires a 0.002-kilogram bullet. As the bullet leaves the rifle with a velocity of 500 meters per second, what is the momentum of the rifle-bullet system?

   A. 2.5 kg · m/s B. 2.0 kg · m/s

   C. 0.5 kg · m/s D. 0 kg · m/s

7. A spring is compressed between two stationary blocks as shown in the diagram. Block *A* has a mass of 6.0 kilograms. After the spring is released, block *A* moves west at 8.0 meters per second and block *B* moves east at 16 meters per second. What is the mass of block *B*? [Assume no frictional effects.]



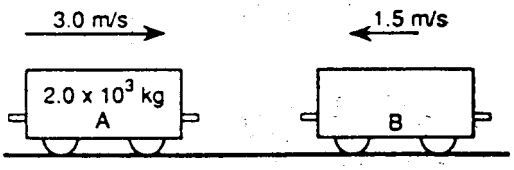
   A. 16 kg B. 12 kg C. 3.0 kg D. 6.0 kg

8. A 2.0-kilogram ball traveling north at 4.0 meters per second collides head on with a 1.0-kilogram ball traveling south at 8.0 meters per second. What is the magnitude of the total momentum of the two balls after collision?

   A. 0 kg · m/s B. 8.0 kg · m/s

   C. 16 kg · m/s D. 32 kg · m/s

9. Two railroad carts, *A* and *B*, are on a frictionless, level track. Cart *A* has a mass of 2.0×10^3 kilograms and a velocity of 3.0 meters per second toward the right. Cart *B* has a velocity of 1.5 meters per second toward the left. The magnitude of the momentum of cart *B* is 6.0×10^3 kilogram-meters per second. When the two carts collide, they lock together.



A. What is the magnitude of the momentum of cart *A* before the collision? (Show all calculations, including equation and substitutions with units.)

B. On the diagram, construct a scaled vector that represents the momentum of cart *A* before the collision. The momentum vector *must* be drawn to a scale of 1.0 centimeter = 1,000 kilogram-meters per second. [Be sure your final answer has the correct labels (numbers and units).]

C. In one or more *complete sentences*, describe the momentum of the two carts after the collision and justify your answer based on the initial momenta of both carts.

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1.
Answer: C

2.
Answer: D

3.
Answer: C

4.
Answer: D

5.
Answer: D

6.
Answer: D

7.
Answer: C

8.
Answer: A

9.
Answer: 6.0×10^3 kilogram-meters per second; [see diagram]; [see description]