

## Impulse Problems

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### Concept Review:

- A. *What is momentum and what are its units?*
  
- B. *What is impulse and what are its units?*
  
- C. *How are momentum and impulse related to each other?*
  
- D. *What is meant by the phrase "change in momentum?" How about "change in velocity?"*

### Change in Momentum

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1. A 2 kg ball at rest is kicked and has a final velocity of 15 m/s. What was the change in momentum of the ball?
  
2. A 2 kg ball is moving with a velocity of 15 m/s when someone catches it. What is the change in momentum of the ball?
  
3. A 1500 kg car speeds up from 10 m/s to 25 m/s. What is its change in momentum?
  
4. A 1200 kg starts at rest, and undergoes a change in momentum of 20,000 kg•m/s. What is its final velocity?
  
5. A 25 kg rock has an initial velocity of 10 m/s. What is its final velocity if its change in momentum was 350 kg•m/s?
  
6. A 25 kg rock has an initial velocity of 10 m/s. What is its final velocity if its change in momentum was -350 kg•m/s?

### Impulse

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7. A box is pushed with a force of 150 N for 2 seconds. What impulse was exerted on the box?
  
8. A box is pushed with a force of 150 N for 10 seconds. What impulse was exerted on the box?

## Impulse Problems

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9. 0.15 kg ball is hit with a force of 170 N for 0.25 seconds. What impulse was exerted on the ball?
10. How much force is needed to exert an impulse of 50 N•s in 15 seconds? How about in 2 seconds? How about 0.003 seconds?
11. How much time is needed for a 4.5 N force to create an impulse of 12 N•s?

### *All Together*

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12. What impulse is needed to make a 2.5 kg ball go from rest to 23 m/s?
13. What impulse is needed to stop a 0.15 kg egg traveling at 1.3 m/s?
14. A 2.5 kg ball is traveling with a velocity of 20 m/s to the right. What impulse is needed to make the ball move at 20 m/s to the left?
15. What is the change in momentum of an object if a force of 75 N is exerted on it for 3 seconds?
16. A 0.5 kg cart is at rest on a table. An explosion gives the cart a speed of 1.2 m/s in only 0.2 seconds. What was the force on the cart from the explosion?
17. A 1200 kg car traveling is traveling at 30 m/s when it hits the brakes. If the braking force of 2000 N lasts for 7 seconds, what is the final velocity of the car?

### *Answers:*

- 1) 30 kg•m/s    2) -30 kg•m/s    3) 22,500 kg•m/s    4) 16.7 m/s    5) 24 m/s    6) -4 m/s  
7) 300 N•s    8) 1500 N•s    9) 42.5 N•s    10) 3.3 N, 25 N, 16,700 N    11) 2.67 s  
12) 57.5 N•s    13) -0.2 N•s    14) -100 N•s    15) 225 kg•m/s    16) 3 N    17) 18.3 m/s