

## Unit 5: Momentum

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**Text:**

Chapter 9

*Problems (p. 229-240)*

#1: 18, 20, 27, 31, 37

*(momentum & impulse)*

#2: 40, 42, 45, 46, 100

*(conservation of momentum)*

#3: 49, 103, 123, 129

*(collisions)***Vocabulary:**

momentum, impulse, center of mass, conservation of momentum, elastic collision, inelastic collision

**Math:**

definitions:

$$\bar{p} = m\bar{v} \qquad r = \frac{\sum m_i x_i}{M} = \frac{1}{M} \int x dm$$

derived formulas:

$$J = \int \bar{F} dt = (\bar{F}_{ave} t)$$

$$v_{1f} = \frac{m_1 - m_2}{(m_2 + m_1)} v_{1i} + \frac{2m_2}{(m_2 + m_1)} v_{2i} \qquad v_{2f} = \frac{2m_1}{(m_2 + m_1)} v_{1i} + \frac{(m_2 - m_1)}{(m_2 + m_1)} v_{2i}$$

skills:

no new math skills

**Objectives:**

You should be able to do the following:

- Explain what is meant by the center of mass and why it is important - especially in regards to Newton's Laws and momentum.
- calculate the center of mass for a collection of masses.
- Explain the concept of conservation of momentum. Use examples to support your explanation.
- Explain what is meant by the term "impulse" and how it relates to momentum. Use examples to support your explanation.
- Compare and contrast the phrases "elastic collision" and "inelastic collision." Use examples to support your explanation.
- Calculate impulse (or change in momentum) given an appropriate graph and information.
- Do problems involving the following ideas:
  - ◆ an object (or objects stuck together), perhaps moving, explodes into two or more pieces with different masses and velocities.
  - ◆ an object bouncing off a wall experiences an impulse (and change in momentum)
  - ◆ two objects collide (either elastically or inelastically) in one dimension and have new velocities after the collision.
  - ◆ two objects collide (either elastically or inelastically) in two dimensions, and have new velocities after the collision.