Worksheet 22
Module 9.5 Conservation of Linear Momentum
Module 9.6 Momentum and Kinetic Energy in Collisions
Module 9.7 Elastic Collisions in One Dimension
Module 9.8 Collisions in Two Dimensions
Problems 42, 49, 73, 74

----- Problem 1 ----- A 59 kg person sits with a large box of mass 24 kg at the center of a frictionless frozen pond. To get to the edge of the pond, the person pushes off of the box attaining a velocity of 0.85 m/s East.

- What is the velocity of the box after the push?

----- Problem 2 ----- A horizontally fired .012 kg bullet embeds into a 2.4 kg ballistic pendulum. The "bullet + pendulum" swings rising 0.12 m vertically.

- What was v_0 of the bullet?

----- Problem 3 ----- Block **A** of mass $5\,m$ moves along the $-x$ axis approaching the origin with $v_x = +v_0$. It collides elastically with block **B** of mass $3\,m$ that lies at rest at the origin.

- What is the velocity of block B after the collision?

----- Problem 4 ----- Clay lump **A** of mass 1.8 kg has velocity $\vec{v}_{\rm A} = 2.5\,\hat{i}$ m/s. Clay lump **B** of mass 3.7 kg has velocity $\vec{v}_{\rm B} = (-.75\,\hat{i} + 1.7\,\hat{j})$ m/s. The lumps collide and stick together.

- What is the final velocity of the big lump?
- What percentage of this system's initial kinetic energy converted into thermal energy?

Answers
1. v_2fx = -2.0896 m/s (West)
2. v_0 = 308.26 m/s
3. v_Bx = (5/4)*v_0
4. v_f = (0.313636 ihat + 1.143636 jhat) m/s, (% to heat) = 67.8%