

LAB PHYSICS - TEST CHAPTER 7[B]
MOMENTUM CONSERVATION - 100 PTS

1997-98

BE SURE TO SHOW ALL WORK CAREFULLY!

1. A block, which has a mass of $m_1 = 9.50$ kg is moving toward the left with a velocity of $v_1 = 7.20$ m/sec when it collides with a second block which has a mass of $m_2 = 5.50$ kg. and is also moving toward the left but with a velocity of $v_2 = 4.60$ m/sec.



- a. What is the momentum of m_1 before the collision? [5 pts]
- b. What will be the total momentum of this system before the blocks collide ? [5 pts]
- c. What will be the total momentum of this system after the blocks collide ? [5 pts]

Suppose that the collision between these two blocks is completely elastic.

- d. What will be the velocity of each of these blocks after the collision ? [5 pts]

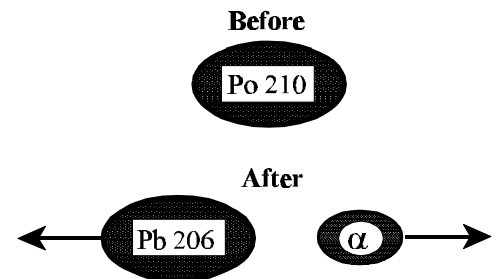
Suppose, instead, that the collision between these two blocks is inelastic and that the coefficient of restitution is $e = 0.68$.

- e. What will be the velocity of each of these blocks after the collision ? [5 pts]

Suppose, instead, that block m_1 runs into the mass m_2 and sticks to it.

- f. What will be the final velocity of these two blocks immediately after the collision ? [5 pts]
- g. How much energy was lost in this collision ? [5 pts]

2. Polonium 210 is a radioactive isotope which has a mass of 210 AMU. [1 AMU = 1.66×10^{-27} kg.] When this isotope undergoes Alpha decay the nucleus emits a Helium nucleus which has a mass of 4 AMU. The remaining nucleus is Lead 206. The alpha particle is emitted with a kinetic energy of 1.02×10^{-12} Joules.



- a. What is the total momentum of this system before the Polonium atom decays ? [5 pts]
- b. What will be the total momentum of this system immediately after the Polonium atom decays ? [5 pts]
- c. What will be the velocity of the Alpha particle immediately after the Polonium atom decays ? [5 pts]
- d. What will be the momentum of the Alpha particle immediately after the Polonium atom decays ? [5 pts]
- e. What will be the momentum of the Lead atom immediately after the Polonium atom decays ? [5 pts]
- f. What was the velocity of the Lead atom immediately after the Polonium atom decays ? [5 pts]
- g. How much energy was released in this decay process ? [5 pts]

Suppose that the Alpha particle then collides elastically and head on with a Gold atom which has a mass of 197 AMU and is initially at rest.

- h. What will be the resulting final velocities for the Alpha particle and the Gold atom after this second collision ? [5 pts]
- i. What percentage of the Alpha particle's kinetic energy is transferred to the Gold atom in this elastic collision ? [5 pts]

[CONTINUED ON OTHER SIDE!]

LAB PHYSICS - TEST CHAPTER 7[B]
MOMENTUM CONSERVATION - 100 PTS

1997-98

3. A bowling ball, which has a mass of 6.80 kg., is moving down a bowling alley with a velocity of 11.2 m/sec when it collides with a bowling pin, which has a mass of 0.830 kg and which is initially at rest. After the collision the bowling ball is deflected to the left of the original path of motion at an angle of $\alpha = 4.59^\circ$ while the bowling pin is deflected to the right of the original path of motion at an angle of $\beta = 20.8^\circ$ as shown to the right.

- a. What will be the speed of the bowling ball after the collision ? [5 pts]
- b. What will be the speed of the bowling pin after the collision ? [5 pts]
- c. What will be the coefficient of restitution [elasticity] of this collision ? [5 pts]
- d. How much energy was lost in this collision ? [5 pts]
- e. What was the magnitude of the impulse delivered to the bowling pin? [5 pts]

