

$$\text{ave.} = 8.2$$

$$\sigma = 2.1$$

Name Answer Key

Lab: 8:00 am 11:10 am 2:30 pm (circle one)

Quiz #9: Impulse and Momentum

Problem 1 (2 points)

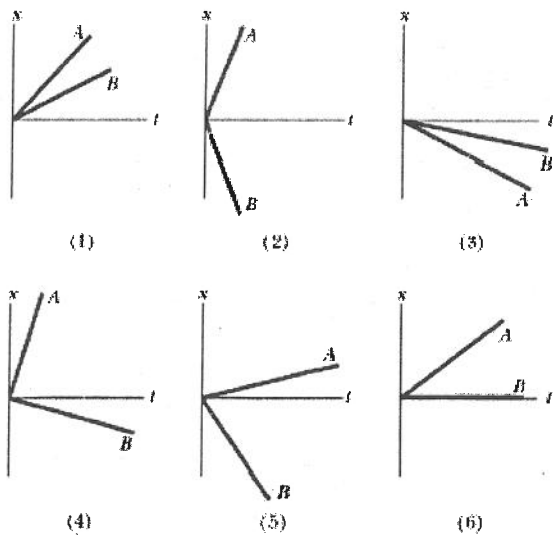
A stunt person jumps from the roof of a tall building, but no injury occurs because the person lands on a large, air-filled bag. Which one of the following best describes why no injury occurs?

- a) The bag provides the necessary force to stop the person.
- b) The bag reduces the impulse to the person.
- c) The bag increases the amount of time the force acts on the person and reduces the change in momentum.
- d) The bag decreases the amount of time during which the momentum is changing and reduces the average force on the person.
- e) The bag increases the amount of time during which the momentum is changing and reduces the average force on the person.**

E

Problem 2 (3 points)

An initially stationary box on a frictionless floor explodes into two pieces: piece A with mass m_A and piece B with mass m_B . These pieces then move across the floor along an x axis. Graphs of position versus time for the two pieces are given below.



since box is stationary,
 $\vec{P}_i = 0$ so $\vec{P}_f = 0$ and pieces
 most move in opposite directions

a) Which graphs pertain to physically possible explosions?

2, 4, and 5

Of those graphs, which best corresponds to the situation in which

b) $m_A = m_B$?

2

c) $m_A > m_B$?

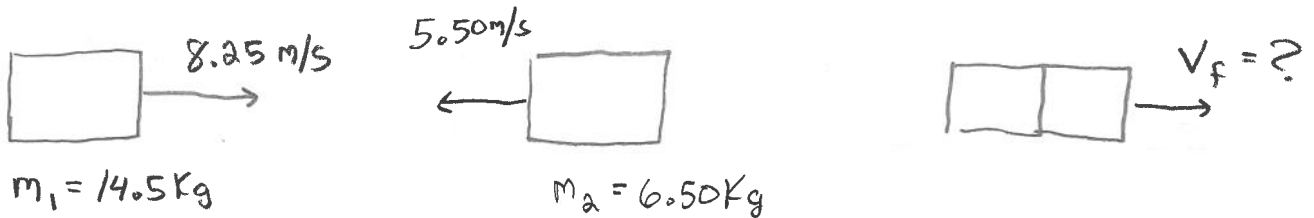
5

d) $m_A < m_B$?

4

Problem 3 (5 points)

A 14.5 kg object is traveling at 8.25 m/s to the right and collides with a 6.50 kg object traveling at 5.50 m/s to the left. If the two objects stick together after the collision, how much kinetic energy is lost during the collision?



system: both objects

$$\sum \vec{F}_{\text{ext},x} = 0 \quad \text{so} \quad P_{f,x} = P_{i,x}$$

$$(m_1 + m_2) V_f = m_1 V_{1i} + m_2 V_{2i} \quad \text{note: } V_{2i} = -5.50 \text{ m/s}$$

$$V_f = \frac{m_1 V_{1i} + m_2 V_{2i}}{m_1 + m_2} = \frac{(14.5 \text{ kg})(8.25 \text{ m/s}) + (6.50 \text{ kg})(-5.50 \text{ m/s})}{14.5 \text{ kg} + 6.50 \text{ kg}}$$

$$V_f = \underline{3.99 \text{ m/s}}$$

$$K_i = \frac{1}{2} m_1 V_{1i}^2 + \frac{1}{2} m_2 V_{2i}^2$$

$$= \frac{1}{2} (14.5 \text{ kg})(8.25 \text{ m/s})^2 + \frac{1}{2} (6.50 \text{ kg})(5.50 \text{ m/s})^2 = \underline{592 \text{ J}}$$

$$K_f = \frac{1}{2} (m_1 + m_2) V_f^2 = \frac{1}{2} (14.5 \text{ kg} + 6.50 \text{ kg})(3.99 \text{ m/s})^2 = \underline{167 \text{ J}}$$

$$K_{\text{lost}} = K_i - K_f = \boxed{425 \text{ J}}$$