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Collision Practice Problems: Name: _____

1. A 1850 kg sedan stopped at a tragic light is struck from the rear by a compact car with a mass of 975 kg. The two cars become entangled (inelastic) as a result. If the compact car was moving at a velocity of 22 m/s, what is the velocity of the entangled mass after the collision?

Chart:

sedan	compact car
$m_1 = 1850\ kg$	$m_2 = 975\ kg$
$V_{1i} = 0\ m/s$	$V_{2i} = 22\ m/s$
$V_f = ?$	

Formula: $m_1 V_{1i} + m_2 V_{2i} = (m_1 + m_2) V_f$

Plug in numbers :

$(1850\ kg)(0\ m/s) + (975\ kg)(22\ m/s) = (1850 + 975) V_f$

$0\ m/s + \frac{21450\ kg\,m/s}{2825} = \frac{2825\ kg\,(V_f)}{2825}$

Answer: $V_f = 7.59\ m/s$

2. A 0.015 kg marble sliding to the right at 0.225 m/s on a frictionless surface makes an elastic head on collision with a 0.024 kg bouncy ball moving to the left at 0.18 m/s. After the collision, the marble moves to the left at 0.16 m/s. What is the velocity of the bouncy ball after the collision?

Chart:

marble	bouncyball
$m_1 = 0.015\ kg$	$m_2 = 0.024\ kg$
$V_{1i} = 0.225\ m/s$	$V_{2i} = -0.18\ m/s$
$V_{1f} = -0.16\ m/s$	$V_{2f} = ?$

Formula: $m_1 V_{1i} + m_2 V_{2i} = m_1 V_{1f} + m_2 V_{2f}$

Plug in numbers :

$(0.015\ kg)(0.225\ m/s) + (0.024\ kg)(-0.18\ m/s) = (0.015\ kg)(-0.16\ m/s) + (0.024\ kg)(V_2)$

$.003375\ kg\,m/s + -0.00432\ kg\,m/s = -0.0024\ kg\,m/s + (0.024\ kg) V_2$

$-0.000945\ kg\,m/s = -0.0024\ kg\,m/s + (0.0024\ kg) V_2$

$+0.0024 \quad +0.0024$

$\frac{.001455}{0.0024} = \frac{0.0024\, V_2}{0.0024}$

Answer: $V_2 = 0.061\ m/s$

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3. A dry cleaner throws a 22 kg bag of laundry into a stationary 9.0 kg cart. The cart and the laundry bag begin moving 3.0 m/s to the right (inelastic). What was the velocity of the bag before the collision?

Chart:

bag	cart
$m_1 = 22\text{kg}$	$m_2 = 9\text{ kg}$
$V_{1i} = ?$	$V_{2i} = 0\text{ m/s}$
$V_f = 3\text{ m/s}$	

Formula: $m_1V_{1i} + m_2V_{2i} = (m_1 + m_2)V_f$

Plug in numbers:

$(22\text{kg})(V) + 9\text{kg}(0) = (22 + 9)3\text{ m/s}$

$22V = 31(3)$

$\frac{22V}{22} = \frac{93}{22}$

Answer: $V = 4.2\text{ m/s}$

4. A 16.0 kg canoe moving to the left at 12 m/s makes an elastic head-on collision with a 4.0 kg raft moving to the right at 6.0 m/s. After the elastic collision, the raft moves to the left at 22.7 m/s. What is the velocity of the canoe after the collision?

Chart:

canoe	raft
$m_1 = 16\text{kg}$	$m_2 = 4\text{ kg}$
$V_{1i} = -12\text{ m/s}$	$V_{2i} = 6\text{ m/s}$
$V_{1f} = ?$	$V_{2f} = -22.7\text{ m/s}$

Formula: $m_1V_{1i} + m_2V_{2i} = m_1V_{1f} + m_2V_{2f}$

Plug in numbers:

$(16)(-12) + (4)(6) = (16)(V) + (4)(-22.7)$

$-192 + 24 = 16V + -90.8$

$-168 = 16V - 90.8$

$+90.8 \quad +90.8$

$\frac{-77.2}{16} = \frac{16V}{16}$

Answer: $V = -4.8\text{ m/s}$