Physics 12 Unit 4 – Momentum Worksheet #3

(2-D) Problems including Gov Problems

Key

Name: _____ Date: _____

Momentum is a vector quantity

1. Obliquely means at an angle.

A 0.25 kg ball moving north at 7.7 m/s strikes a wall obliquely and rebounds heading east with the same speed of 7.7 m/s. What was the magnitude and direction of the impulse on the ball?

	Magnitude of the Impulse	Direction of the Impulse
A.	1.9 N·s	Due East
B.	1.9 N·s	45°S of E
C.	2.7 N·s	Due East
D.	2.7 N·s	45°S of E

impulse

$\Delta p = p_f - p_i$

$= p_f + (-p_i)$

p_f 1.925 NS

$p_i = mv = (.25)(7.7) = 1.925$ N/S.

North.

p_f

$-p_i$

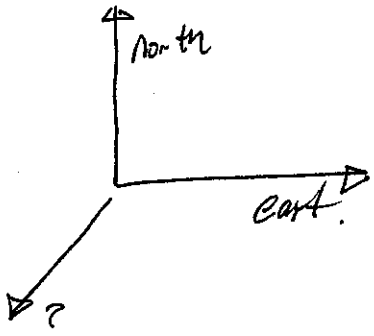
Resultant = Δp = impulse → direction is SE.

2. The momentum initial was zero so the final needs to be zero as well.

A 1.0 kg physics puck is at rest when a small explosion breaks it into three pieces. A 0.50 kg piece goes north at 10 m/s and a 0.30 kg piece goes east at 20 m/s. What is the magnitude of the momentum of the third piece?

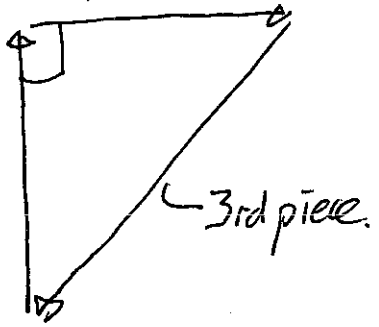
A. 1.0 kg m/s
B. 3.3 kg m/s
C. 7.8 kg m/s
D. 11 kg m/s

means the three vectors will add tip to tail to zero.



$p = mv = (3)(20) = 6\ N{\cdot}s$

$p = mv$
$= (0.5)(10)$
$= 5\ N{\cdot}s$



use pythagorean

$a^2 + b^2 = c^2$ ← 3rd piece.

$5^2 + 6^2 = c^2$

$c = 7.81\ N{\cdot}s$

3. impulse = Pf - Pi

A 1 000 kg vehicle travelling westward at 15 m/s is subjected to a 1.0×10^4 N·s impulse northward. What is the magnitude of the final momentum of the vehicle?

A. 5.0×10^3 kg·m/s
B. 1.5×10^4 kg·m/s
C. 1.8×10^4 kg·m/s
D. 2.5×10^4 kg·m/s

10,000 N·s

$mv = (1000)(15) = 15{,}000$ N·s

$\Delta p = p_f - p_i$

$\Delta p = p_f + (-p_i)$ means east.

OR

$\Delta p + p_i = p_f$

$p_i = 15{,}000$ N·s

$\Delta p = 10{,}000$ N·s

$p_f = ?$

Pythagoras

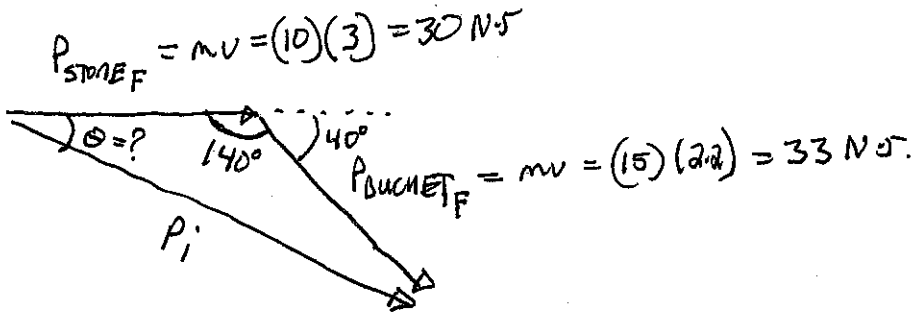
18,027 N·s

4. Pi = Pf, you have Pf so find Pi.

(5 marks) $p=?$ $p=0$

A 10 kg curling stone is sliding along the ice when it hits a stationary 15 kg bucket of sand. P_i
After the collision, the curling stone's velocity is 3.0 m/s east, and the bucket has a velocity of 2.2 m/s, 40° S of E.

What direction was the curling stone moving before the collision?



① use cosine law

$$c^2 = a^2 + b^2 - 2ab\cos\theta$$

$$P_i^2 = 30^2 + 33^2 - 2(30)(33)\cos 140°$$

$$P_i^2 = 3505.7$$

$$P_i = 59.208 \text{ N·s}$$

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② use sin Law.

$$\frac{\sin\theta}{33} = \frac{\sin 140}{59.208}$$

$$\sin\theta = 0.35826 \rightarrow \theta = 21°$$

$\sin^{-1}$