MOMENTUM

Lesson 1—Momentum and Impulse

PRACTICE EXERCISES ANSWERS AND SOLUTIONS

1. $\vec{p} = m\vec{v}$
$= (4.0 \text{ kg})(12.0 \text{ m/s east})$
$= 48 \text{ kg} \cdot \text{m/s east}$

2. $\vec{p} = m\vec{v}$
$\vec{v} = \dfrac{\vec{p}}{m}$
$= \dfrac{25.0 \text{ kg} \cdot \text{m/s west}}{5.0 \text{ kg}}$
$= 5.0 \text{ m/s west}$

3. $\vec{p} = m\vec{v}$
$m = \dfrac{\vec{p}}{\vec{v}}$
$= \dfrac{36.0 \text{ kg} \cdot \text{m/s south}}{8.0 \text{ m/s south}}$
$= 4.5 \text{ kg}$

4. $\vec{p} = m\vec{v}$
$m = \dfrac{\vec{p}}{\vec{v}}$
$= \dfrac{29 \text{ kg} \cdot \text{m/s east}}{2.0 \text{ m/s east}}$
$= 14.5 \text{ kg}$

$F_g = mg$
$= (14.5 \text{ kg})(9.81 \text{ m/s}^2)$
$= 1.4 \times 10^2 \text{ N}$

5. $F_g = mg$
$m = \dfrac{F_g}{g}$
$= \dfrac{6.6 \text{ N}}{9.81 \text{ m/s}^2}$
$= 0.673 \text{ kg}$

$\vec{p} = m\vec{v}$
$= (0.673 \text{ kg})(3.0 \text{ m/s north})$
$= 2.0 \text{ kg} \cdot \text{m/s north}$

6. $\vec{v} = \dfrac{\vec{d}}{t}$
$= \dfrac{2.6 \text{ m west}}{1.1 \text{ s}}$
$= 2.36 \text{ m/s west}$

$\vec{p} = m\vec{v}$
$= (7.0 \text{ kg})(2.36 \text{ m/s west})$
$= 17 \text{ kg} \cdot \text{m/s west}$

7. $\vec{a} = \dfrac{\vec{v} - \vec{v}_0}{t}$
$-9.81 \text{ m/s}^2 = \dfrac{\vec{v} - 0}{0.25 \text{ s}}$
$\vec{v} = -2.45 \text{ m/s}$

$\vec{p} = m\vec{v}$
$= (5.0 \text{ kg})(-2.45 \text{ m/s})$
$= -12 \text{ kg} \cdot \text{m/s}$
$= 12 \text{ kg} \cdot \text{m/s down}$

8. Impulse $= \vec{F}_{net} t$
$= (17.0 \text{ N east})(2.5 \times 10^2 \text{ s})$
$= 4.3 \times 10^{-1} \text{ N} \cdot \text{s east}$

9. Impulse $= \vec{F}_{net} t$
$t = \dfrac{\text{Impulse}}{\vec{F}_{net}}$
$= \dfrac{7.00 \text{ N} \cdot \text{s west}}{11.2 \text{ N west}}$
$= 0.625 \text{ s}$

10. Consider north direction as positive
$\vec{F}_{net} t = m\Delta\vec{v}$
$\vec{F}_{net}(2.60 \text{ s}) = (26.3 \text{ kg})(-21.0 \text{ m/s})$
$\vec{F}_{net} = -212 \text{ N or } 212 \text{ N south}$

11. Magnitude of impulse
$\vec{F}_{net} t = m\Delta\vec{v}$
$(31.6 \text{ N})t = (15.0 \text{ kg})(10.0 \text{ m/s})$
$t = 4.75 \text{ s}$

12. $\vec{F}_{net} t = m\Delta\vec{v}$
Therefore, $m\Delta\vec{v} = (25.0 \text{ N})(7.20 \times 10^{-1} \text{ s})$
$= 18.0 \text{ N} \cdot \text{s north}$

