Name: Key

Chapter 8 Practice Test

I. MULTIPLE CHOICE: Choose the one best answer each. Assume g = 10 m/s^2.

1. The momentum of an object is proportional to its
   A. Velocity
   B. Mass
   C. Mass x Velocity
   D. All of the above
   E. None of the above

2. Impulse is equal to the change of
   A. Velocity
   B. Mass
   C. Force
   D. Momentum
   E. Force x Velocity

3. In order to double the momentum of an object, its velocity must change by a factor:
   A. x 2 B. x 1/2 C. x 4 D. x 1/4

4. When a force F is applied to an object on a frictionless surface over a time interval, a change in velocity is created. If the time interval the force is applied increases by a factor of 2, what applied force below would yield the same change in velocity for the object?
   A. 2F B. F/2 C. 4F D. F/4

5. One egg is thrown against a solid wall, while a second egg is thrown against a hanging bed sheet. Both eggs have the same initial velocity (35 miles per hour) and the same final velocity (zero miles per hour). Which egg experiences a greater <u>change in momentum</u>?
   A. The egg stopped by the wall.
   B. The egg stopped by the hanging sheet.
   C. Both eggs experience the same change in momentum.

6. One egg is thrown against a solid wall, while a second egg is thrown against a hanging bed sheet. Both eggs have the same initial velocity (35 miles per hour) and the same final velocity (zero miles per hour). Which egg experiences a greater <u>force</u>?
   A. The egg stopped by the wall.
   B. The egg stopped by the hanging sheet.
   C. Both eggs experience the same force.

7. Which has the most momentum below?
   A. a mass of 5.0 kg moving at 0.0 m/s
   B. a mass of 2000 g moving at 500.0 cm/s
   C. a weight of 30 N moving at 4.0 m/s
   D. a mass of 1.5 kg moving at 6.0 m/s

$2\,kg \times 5\,\frac{m}{s} = 10$
$3\,kg \times 4\,\frac{m}{s} = 12$
9

8. Mass M_1 moving with a speed v_i collides with stationary mass M_2. After the collision, the masses are interlocked and moving with a speed of $v_i/3$. Which equation below correctly describes the relationship between M_1 and M_2?
   A. $M_2 = 2M_1$ B. $M_1 = 2M_2$ C. $M_2 = 3M_1$ D. $M_1 = 3M_2$

$m_1 v_i = (m_1 + m_2) v_f \leftarrow \frac{v_i}{3} \Rightarrow 3m_1 = m_1 + m_2 \Rightarrow 2m_1 = m_2$

9. A ball moving to the left strikes a wall at a speed of 4 m/s and rebounds to the right at a speed of 2 m/s. What is the change in velocity Δv of the ball?
   A. 0 m/s B. 2 m/s C. 4 m/s D. 6 m/s E. 8 m/s

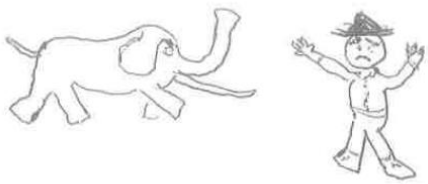
10. A 1,200-kilogram car traveling at 10.0 meters per second hits a tree and is brought to rest in 0.10 second. What is the magnitude of the average force acting on the car to bring it to rest?
   A. 1.2×10^2 N
   B. 1.2×10^3 N
   C. 1.2×10^4 N
   D. 1.2×10^5 N
   E. 1.2×10^6 N

$F = \frac{\Delta p}{t} = \frac{1200\,kg \times 10\,\frac{m}{s}}{0.10\,s} = 1.2 \times 10^5\,\frac{kg\,m}{s^2}$

(1) $p = mv$

$= (2250\,kg)\left(7.00\,\frac{m}{s}\right)$

$= \boxed{1.58 \times 10^4\,\frac{kg\,m}{s}}$



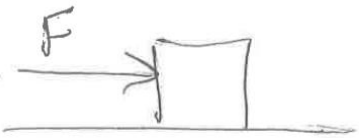
(2) $Ft = \Delta p = \Delta mv$ $\quad v_i = 0$

$\Rightarrow \Delta v = \frac{Ft}{m}$

$v_f = \frac{(25.0\,N)(0.180\,s)}{0.122\,kg} = \boxed{36.9\,\frac{m}{s}}$

(3) $Ft = \Delta p \Rightarrow t = \frac{\Delta p}{F}$

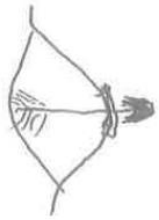
$t = \frac{(4.00\,kg)\left(4.40\,\frac{m}{s}\right) - 0}{12.0\,N} = \boxed{1.47\,s}$



(4) (A) $Ft = \Delta p = m\Delta V$

$= \left(65.0\times10^{-3}\,kg\right)\left(54\frac{m}{s} - 0\right)$

$= \boxed{3.51\,\frac{kg\,m}{s}}$



(B) $Ft = \Delta p \Rightarrow F_{AVG} = \frac{\Delta p}{t}$

$F_{AVG} = \frac{3.51\,\frac{kg\,m}{s}}{9.0\times10^{-3}\,s} = \boxed{3.90\times10^{2}\,N}$

(5) $p_i = p_f$

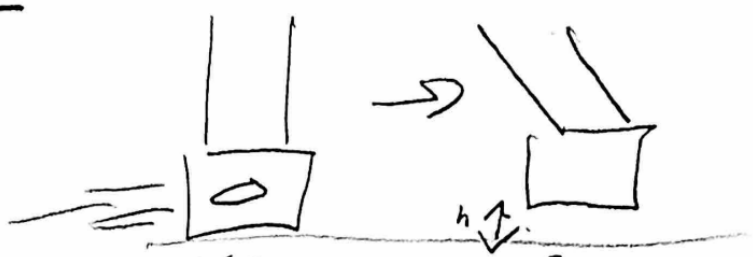
$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$

$v_f = \frac{m_1 v_{1i} + m_2 v_{2i}}{m_1 + m_2}$

$= \frac{\left(1.90\,kg\right)\left(26.0\frac{m}{s}\right) + \left(0.600\,kg\right)\left(6.00\frac{m}{s}\right)}{\left(1.90 + 0.600\,kg\right)}$

$= \boxed{21.2\,\frac{m}{s}}$

"Bonus!"

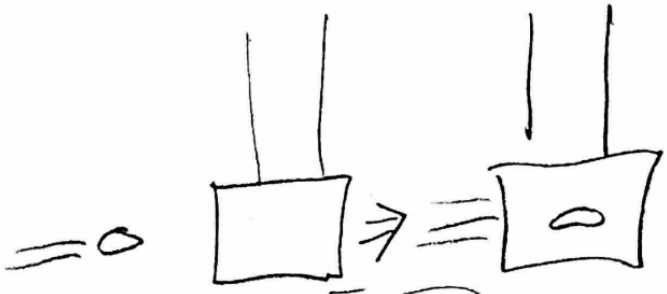


KE = PE

Energy is conserved

$\frac{1}{2}mv_{tot}^2 = mgh$

$v_{tot} = \sqrt{2gh}$



Momentum is conserved

$m_{bullet}v_{bullet} + m_{target}v_{target} = m_{total}v_{total}$

v_{target} = Zero

Before Collision → $m_{bullet}v_{bullet} = m_{total}v_{total}$ ← After collision

$v_{bullet} = \frac{m_{total}(\sqrt{2gh})}{m_{bullet}}$ (1.88 m/s)

$v_{bullet} = \frac{(0.014kg + 2.5kg)(\sqrt{2(9.8m/s^2)(0.18m)})}{0.014kg}$

$v_{bullet} = 337 m/s$

6. $e = \dfrac{V_B' - V_A'}{V_A - V_B} \Rightarrow 0.4 = \dfrac{-1\,m/s - V_A'}{1\,m/s - (-3\,m/s)}$

1st Equation: Coefficient of Restitution

$0.4 = \dfrac{-1\,m/s - V_A'}{4\,m/s}$

$1.6\,m/s = -1\,m/s - V_A'$

$V_A' = -2.6\,m/s$

2nd Equation: Conservation of Momentum $\quad m_A V_A + m_B V_B = m_A V_A' + m_B V_B'$

$0.3(1) + m_B(-3) = 0.3(-2.6) + m_B(-1)$

$0.3 - 3m_B = -0.78 - m_B$

$1.08 = 2m_B$

$m_B = 0.54\,kg$