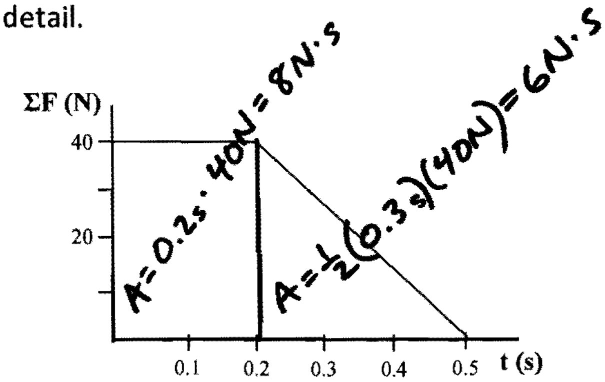
**IP Test Review**

Name KEY
Date: __________ Pd ____

For all the following problems, show your work in extraordinary detail.

A force is applied to a ball according to the graph shown.




1. What impulse is delivered to the ball?

Area under graph:

8N·s + 6N·s = **14N·s**

The above ball has a mass of 500g and was traveling at ~~-20 m/s~~ before it got hit.

0.500kg

2. What will be the ball's change in momentum? = 14N·s

$\Delta p = m\Delta v = (0.500kg \cdot \Delta v) = 14N\cdot s$; divide both sides by .500kg: $\Delta v$ = 28 m/s

$\Delta p$ = imp

3. What will be the ball's change in velocity?

oops - see work above in question #2

answer = 28 m/s

4. What will be its new velocity?

−20 + 28 = **8 m/s**

5. A bumper car with Mickey as the driver (total mass = 100 kg), moving at 10.0 m/s, collides with a stationary bumper car with Minnie as the driver (total mass = 75 kg). After the collision, Mickey's car has a velocity of -2.0 m/s. What is the velocity of Minnie's car after the collision?

$P_i = P_f$

$(100kg \cdot 10\frac{m}{s}) + (75kg \cdot 0\frac{m}{s}) = (100kg \cdot -2.0\frac{m}{s}) + (75kg \cdot V_{f-min})$

$1000 kg\,m/s = -200\frac{kg\,m}{s} + 75kg\,V_{f-min}$

$+200 \qquad +200$

$\frac{1200\frac{kg\,m}{s}}{75kg} = \frac{75 V_{f-min}}{75kg}$

$16\frac{m}{s} = V_{f-min}$

6. A 0.058 kg tennis ball is hit at 50 m/s and hit <u>back</u> at 55 m/s. What is the tennis ball's *change* in momentum?

$\Delta p = m\Delta v$

$= 0.058\,kg\,(-55\,m/s - 50\,m/s) = \boxed{-6.09\,\frac{kg\,m}{s}}$

7. While being thrown, a total force of 135 N acts on a lacrosse ball (mass = 142 g) for a period of 0.06 sec.

a) Calculate the ball's change in momentum.

$\Delta p = Imp = 135\,N \cdot 0.06\,s = 8.1\,N\cdot s = \boxed{8.1\,\frac{kg\,m}{s}}$

b) If the lacrosse ball is initially at rest, what will be its speed when it leaves the player's hand?

$\Delta p = m\Delta v$

$\Delta v = \frac{\Delta p}{m} = \frac{8.1\,\frac{kg\cdot m}{s}}{0.142\,kg} = \boxed{57\,m/s}$

8. An empty train car, coasting at 7 m/s, strikes a loaded car that is stationary and the cars link together. Each of the cars has a mass of 4000 kg when empty, and the loaded car contains 10,000 kg of cargo.

a.) Draw both a "before" picture and an "after" picture of this situation. Label with relevant data.


b.) What type of interaction occurs, elastic, inelastic, or explosive? (circle correct choice)

c.) With what speed does the combination of the two cars start to move?

$p_i = p_f$

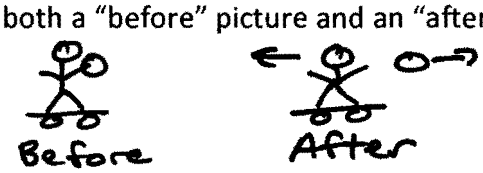
$(4000\,kg \cdot 7\,\frac{m}{s}) + (14{,}000\,kg \cdot 0\,\frac{m}{s}) = (18000\,kg \cdot v_{f\text{-}both})$

$\frac{28000\,kg\,m/s + 0}{18000\,kg} = \frac{18{,}000\,kg\,v_{f\text{-}both}}{18000\,kg}$

$\boxed{v_{f\text{-}both} = 1.56\,m/s}$

9. Your friend is standing on a skateboard with frictionless wheels. Your friend throws a 6.0 kg bowling ball straight back at 10 m/s. Your friend has a mass of 80 kg.

a.) Draw both a "before" picture and an "after" picture of this situation. Label with relevant data.




b.) What type of interaction occurs, elastic, inelastic, or explosive? (circle correct choice)

c.) How fast will your friend roll away?

$(86\,kg \cdot 0\,\frac{m}{s}) = (80\,kg \cdot v_{f\text{-}f}) + (6.0\,kg \cdot 10\,\frac{m}{s})$

$0\,\frac{kg\,m}{s} = 80\,kg\,v_{f\text{-}f} + 60\,\frac{kg\,m}{s}$

$-60\,kg\,m/s$

$\frac{-60\,\frac{kg\,m}{s}}{80\,kg} = \frac{80\,kg\,v_{f\text{-}f}}{80\,kg}$

$\boxed{-0.75\,\frac{m}{s} = v_{f\text{-}f}}$