

Physics 112  
- Quiz Friday

A 5.0 kg fish swimming at 1.0 m/s to the right, swallows a 1.0 kg fish swimming toward it at 4.0 m/s. What is the speed of the large fish immediately after lunch?



5.0 kg

1.0 m/s



1.0 kg

← 4.0 m/s

Momentum Before = Momentum After

Big + Small = Big + Small

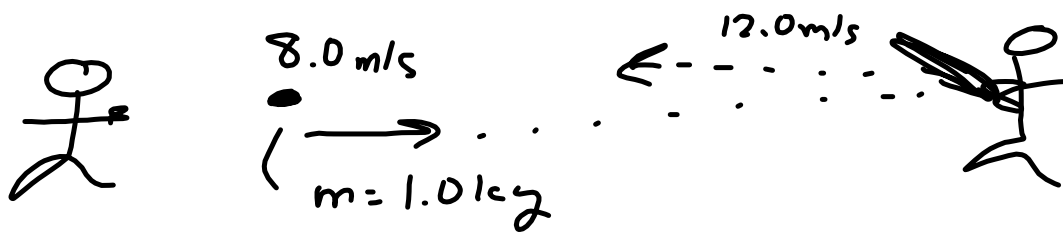
$$(5)(1) + 1(-4) = 6v$$

$$5 - 4 = 6v$$

$$1 = 6v$$

$$1/6 \text{ m/s} = v$$

1/6 m/s to the right.



What force was supplied by the bat, if ball and bat are in contact for 0.25 seconds?

$$F \Delta t = m (v_2 - v_1)$$

$$F = \frac{m (v_2 - v_1)}{\Delta t}$$

$$= \frac{1.0 \text{ kg } (-12 - 8) \text{ m/s}}{0.25 \text{ sec}}$$

$$F = -80 \text{ N}$$

$$= 80 \text{ N Left}$$

Remember

$$j = F \Delta t$$

$$j = \Delta p$$

$$j = p_2 - p_1$$

$$j = mv_2 - mv_1$$

$$j = m(v_2 - v_1)$$

$$j = m(\Delta v)$$

$$j = F \Delta t = m(v_2 - v_1) = m \Delta v \\ = \Delta p = p_2 - p_1$$

$\Delta t$  = Contact  
time

$$F \Delta t = m (v_2 - v_1)$$

Question:

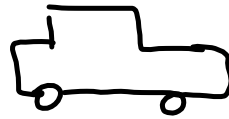
a) Why are vehicles designed to crumple on impact?

b) Why is it important to follow through when hitting a golf ball off a tee?

$$a) F \Delta t = m (v_2 - v_1)$$

Vehicle  
Crumple

Compare Crumple  
to no crumple



$v_1 \rightarrow$  No change  
 $v_2 \rightarrow$  No change (stopped)



$m \rightarrow$  No change

$\Delta t \rightarrow$  Crumple  $\rightarrow$  will get larger

$\therefore F$  must be lower

$\rightarrow$  driver feels  $F$



$$b) \quad F \Delta t = m (v_2 - v_1)$$

Compare follow through to  
Not following through

$m$  → mass of ball does not change

$v_1$  → Ball starts at rest

$F$  → Force you use is same

$\Delta t$  → follow through will increase  
contact time.

$v_2$  → Must go up. Higher velocity  
is what you want.