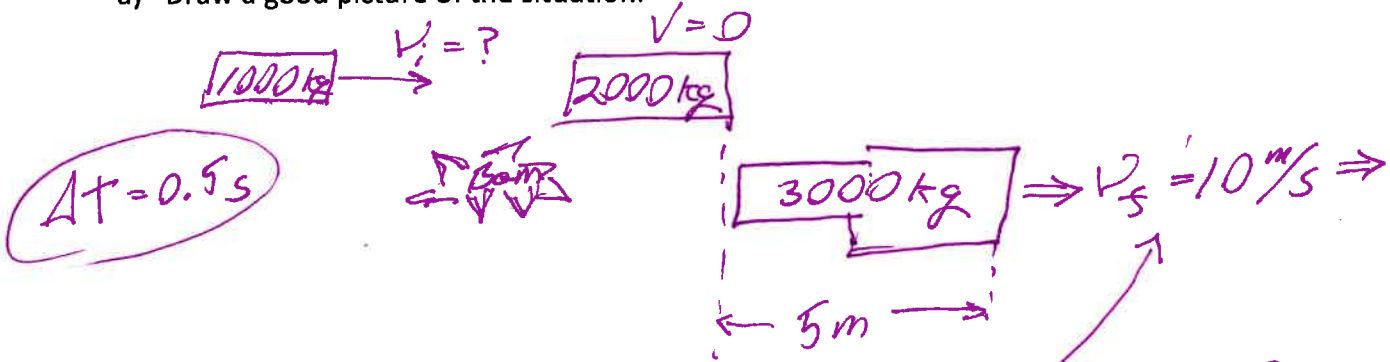


Assessment #1 121 Schwartz

You are taking a video of Sarah sitting in her 2000 kg car and BAM! she's hit by Michael driving a 1000 kg car. The two vehicles stick together. You catch on your video that Sarah is surprised (but unhurt) and the wreckage of the two cars moves 5 meters in the 0.5 s that you record. Michael swears he was driving only 15 m/s (~30 mph) before the collision. I'm not sure. Please estimate his speed from what you are sure of.

a) Draw a good picture of the situation.



b) What lens (or lenses) do you need for this problem?

c) What is the motivation for the lens you picked?

*Kinematics, P*  
 1) The video provides position as an explicit function of time, so I can calculate  $x, v, a, \dots$  if needed.  
 2)  $F \Rightarrow \Delta p$ . Because  $F_{\text{outside}} = 0$ ,  $P_i = P_f$  of the system.

d) Set up equation(s) to solve the problem

$$V_f = \frac{\Delta x}{\Delta t} = \frac{5 \text{ m}}{0.5 \text{ s}} = 10 \text{ m/s}$$

$$\sum P_i = \sum P_f \text{ for system}$$

$$P_f = m_f V_f = 3000 \text{ kg} (10 \text{ m/s}) = 3 \times 10^4 \text{ kg} \cdot \text{m/s}$$

e) Estimate the speed of Michael's car.

Because  $F_{\text{system}} = 0$ ,  $P_i = P_f = 30,000 \text{ kg} \cdot \text{m/s}$

But before the collision,  $V_{\text{Sarah}} = 0$ , so  $P_i = P_f = P_{\text{Michael}}$

$$P_{\text{Mich}} = m_{\text{Mich}} \cdot V_{\text{Mich}} \quad V = \frac{P}{m} = \frac{3 \times 10^4 \text{ kg} \cdot \text{m/s}}{1000 \text{ kg}} = 30 \text{ m/s}$$

f) Reflect on your answer (does this value make sense to you?) and make sure you carried your units throughout your work

*in the collision, the mass of the moving body increased by a factor of 3 so  $V_m = 3 V_f \cdot 30 \text{ m/s}$  is ~ 66 mph. Michael is a liar and was driving irresponsibly!*

- What's your name? John