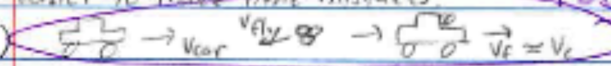
Professor Schwartz
Physics 141
22 September 2018

6/6

Excellent!

Problem Set #1

1) I am someone who likes to find just one concrete answer, so I like formulas and plugging in numbers to find the answer. Formula hunting was always satisfying when you find the right answer. Solving problems using different concepts was always a little more difficult because I like to stick more to one way to finding an answer to a certain type of problem. These experiences were definitely very different, I found the second one more challenging, but usually more rewarding, compared to the first way being easier, but easier to make ~~little mistakes~~. ✓

2) 

Too Small! Great!

Lens: momentum, the exchange of momentum between objects ✓ good

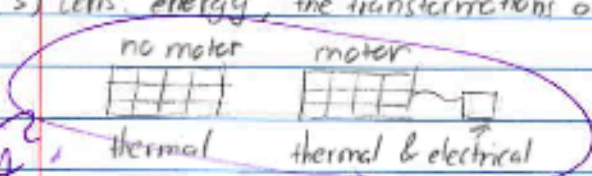
a) There are no outside forces on the car and the fly, so the momentum between fly and car don't really move, they more just exchange momentum. ✓ So the changes in momenta must be equal and opposite

b) $\Delta v_c < \Delta v_f$ $\quad \Delta p = m \Delta v$

Due to the ~~size~~ mass difference of the car and fly the change in velocity of the fly is much greater than the change in velocity of the car. ✓

c) The above answers are not the same because momentum is always constant, while velocity can be accelerated or decelerated. Velocity does not need to be conserved ✓

3) Lens: energy, the transformations of energy. ✓



Lens? too small, Energy Flow diagram 3

The solar panel without the motor is warmer than the one with a motor. The one without a motor is converting solar energy to thermal energy, while the one with the motor is converting solar energy to thermal energy and electrical energy. ✓

4) Lens: Energy, the transformation of chemical potential energy.

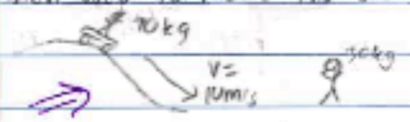
a) The ~~energy~~ Food contains chemical potential energy and once eaten and digested transforms into thermal energy. The KE then transforms into KE by moving up the hill. This kinetic energy is then transformed into gravitational potential energy at the top of the hill, then back to KE down the hill, where you hit the brakes and release thermal energy. ✓

And work... and potential energy?

or light energy Solar energy · or radiant energy

b) Thermal energy from the sun makes its way into a plant through photosynthesis, where the plant then converts the energy into chemical potential energy, which is then used to make the bar

lens?

5) 

Energy Flow diagram?

bigger!

a) lens: energy, because I can see that PE is being converted to KE. My first step would be to conserve energy.

$E_g = E_k$

$mgh = \frac{1}{2}mv^2$

$h_0 = \frac{\frac{1}{2}v^2}{g} = \frac{\frac{1}{2}(10m/s)^2}{10m/s^2} = \frac{\frac{1}{2}100m^2/s^2}{10m/s^2} = \boxed{5m}$

I didn't think I assigned this question – solutions to the other question are on the other solutions. However, I like this work!!

b) lens: kinematic, because with changing positions in the video frames, we have our position based on time. My first step would to find Δx and Δt and use $v = \frac{\Delta x}{\Delta t}$.

Why? Under which conditions?

c) lens: momentum, because momentum is conserved in collisions. My first step would be to find my initial momentum before hitting her and knowing that it is the same as after.

$p = m_i \cdot v_i$ $\quad p_i = 70kg \cdot 10m/s$ $\quad p_i = 700\ kg \cdot m/s$

$p_f = m_f \cdot v_f$ $\quad 700kg \cdot m/s = 100kg \cdot v_f$ $\quad \boxed{v_f = 7m/s}$

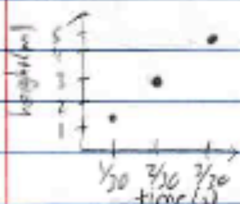
d) lens: energy because PE is converted to KE. I would start by finding all initial energies and setting them equal to the final ones

$E_{ki} + E_p = E_{kf}$ $\quad v_f^2 = (10m/s)^2 + 2(10m/s^2) \cdot 5m$

$\frac{1}{2}mv_i^2 + mgh = \frac{1}{2}mv_f^2$ $\quad v_f^2 = 200\frac{m^2}{s^2}$

$v_f^2 = v_i^2 + 2gh$ $\quad \boxed{v_f = \sqrt{2}(10m/s)} \approx 14m/s$

6) lens: kinematics, time and position

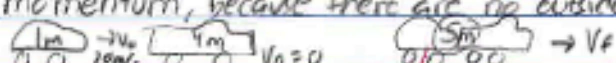


$s = \frac{d}{t} = \frac{1.5m}{1/30s} = \boxed{45\ m/s}$

$\frac{45m}{s} \cdot \frac{60s}{1min} \cdot \frac{60min}{1hr} \cdot \frac{km}{1000m} \cdot \frac{1mi}{1.61km} = \boxed{100\ mi/hr}$

It's very fast, but not unreasonable.

7) lens: momentum, because there are no outside forces, initial momentum = final momentum.



a) $v_f = \frac{1}{5}v_0$

$v_f = \frac{1}{5}(20m/s) = \boxed{4m/s}$

Momentum is a vector

c) $\Delta v_c = 4m/s - 20m/s$ $\quad \Delta v_T = 4m/s - 0m/s$

$\boxed{\Delta v_c = -16m/s}$ $\quad \boxed{\Delta v_T = 4m/s}$

b) $m_c = 1000kg$ $\quad p_c = m_c \Delta v$ $\quad p_T = m_T \Delta v$

$m_T = 4000kg$ $\quad = (1000kg)(-16m/s)$ $\quad = (4000kg)(4m/s)$

$\boxed{p_c = 16000\ kg\frac{m}{s}}$ $\quad \boxed{p_T = 16000\ kg\frac{m}{s}}$

d) momentum is conserved, but velocity is not, velocity is lost by one and gained by the other.