Practice Test 1 Solutions

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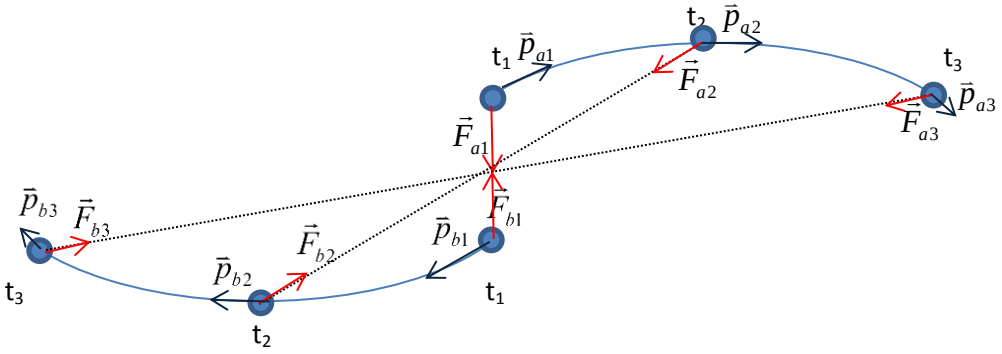
a.

$$p = \frac{mv}{\sqrt{1-\left|\frac{v}{c}\right|^2}} = \frac{(9\times10^{-31}kg)(0.95*3\times10^{8}\ {}^{m}\!/_{s})}{\sqrt{1-(0.95)^2}} = 8.2\times10^{-22}kg\ {}^{m}\!/_{s}$$

b.

$$\frac{F}{A} = Y\frac{\Delta L}{L} \Rightarrow Y = \frac{F\cdot L}{A\cdot\Delta L} = \frac{mg\cdot L}{(w\cdot d)\cdot\Delta L} = \frac{37kg\cdot9.8\ {}^{m}\!/_{s^2}\cdot2.3m}{(1.3\times10^{-3}m\cdot1.6\times10^{-3}m)\cdot2\times10^{-3}m} = 2.0\times10^{11}\ {}^{kg}\!/_{m\cdot s^2}$$

c.



2. a. first interval:

$$\vec{p}_1 = m\frac{\Delta\vec{r}}{\Delta t} = 2.7\times10^{-3}kg\frac{\langle3.25,2.50,-9.40\rangle m - \langle3.17,2.54,-9.38\rangle m}{12.37s-12.35s}$$

$$2.7\times10^{-3}kg\frac{\langle3.25-3.17,2.50-2.54,-9.40+9.38\rangle m}{12.37s-12.35s} = 2.7\times10^{-3}kg\frac{\langle0.08,-0.04,-0.02\rangle m}{0.02s}$$

$$\langle0.0108,-0.0054,-0.0027\rangle kg\ {}^{m}\!/_{s} = \langle10.8,-5.4,-2.7\rangle\times10^{-3}kg\ {}^{m}\!/_{s}$$

b. similarly, second interval has

$$\vec{p}_2 = m\frac{\Delta\vec{r}}{\Delta t} = 2.7\times10^{-3}kg\frac{\langle11.27,-1.86,-11.42\rangle m - \langle11.25,-1.50,-11.40\rangle m}{14.37s-14.35s}$$

$$2.7\times10^{-3}kg\frac{\langle0.02,-0.36,-0.02\rangle m}{0.02s} = \langle2.7,-48.6,-2.7\rangle\times10^{-3}kg\ {}^{m}\!/_{s}$$

c. $\vec{F} = \frac{\Delta \vec{p}}{\Delta t} = \vec{p}_2 = m\frac{\Delta \vec{r}}{\Delta t} = \frac{\langle 2.7,-48.6,-2.7\rangle \times 10^{-3} kg\,{}^{m}\!/\!_{s} - \langle 10.8,-5.4,-2.7\rangle \times 10^{-3} kg\,{}^{m}\!/\!_{s}}{14.35s - 12.35s}$

$\frac{\langle -8.1,-43.2,0\rangle \times 10^{-3} kg\,{}^{m}\!/\!_{s}}{2s} = \langle -4.05,-21.6,0\rangle \times 10^{-3} kg\,{}^{m}\!/\!_{s^2}$

3. this is a test that was given after chapter 5; parts a through d and f of this problem really pertain to chapter 5, and wouldn't be on this year's test. So, skipping to…

e. $F = ks = k(L - L_o) = 1000\,{}^{N}\!/\!_{m}(1.5m - 1.2m) = 300N$

4. Here are the missing lines

planet.p = planet.mass*vector(0,3.4e4,0)

r = star.pos – planet.pos

rmag = sqrt(r.x**2 + r.y**2 + r.z**2) alternatively, can use the "mag" function: rmag = mag(r)

Fmag = G*star.mass*planet.mass/rmag**2

Fnet = Fmag*rhat

planet.p = planet.p + Fnet*deltat

planet.pos = planet.pos + (planet.p/planet.mass)*deltat

g) $\vec{p} = \langle 0,28,0\rangle \times 10^{29} kg\,{}^{m}\!/\!_{s}$

h) 3 hours

i) $\vec{r} = \langle -9e11,4e11,0\rangle m$

j) It tells us the direction of the force. Functionally, multiplying Fmag by it creates the force vector with appropriate components.

k) r = planet.pos - star.pos and then Fnet = -Fmag*rhat