PHYS 1112 Homework #1
Chapter 6 #17, 21
Chapter 17 #7, 20, 22

Wednesday, January 25, 2012
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$1 fm = 10^{-15} m$

$$F = G\frac{m_1 m_2}{r^2}$$

$$F = \left(6.67\times10^{-11} N\frac{m^2}{kg^2}\right)\frac{(1.67\times10^{-27} kg)^2}{(1\times10^{-15} m)^2} = 1.86\times10^{-34} N$$

Chapter 6 #21

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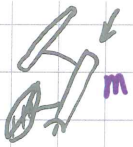

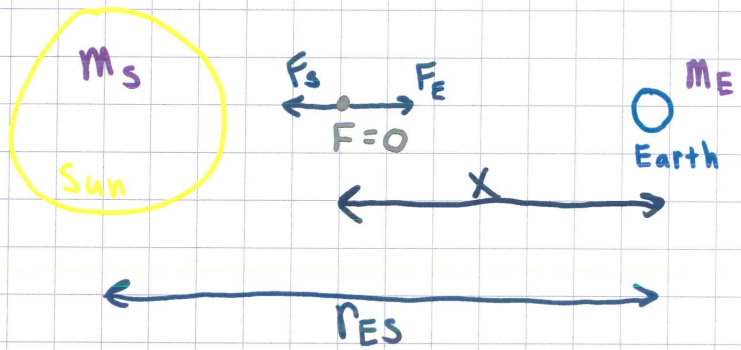

$$\Sigma F = 0$$
$$F_S - F_E = 0$$
$$\frac{m_S m}{(r_{ES}-x)^2} - \frac{m_E m}{x^2} = 0$$
$$\frac{m_S}{(r_{ES}-x)^2} - \frac{m_E}{x^2} = 0$$
$$\frac{m_S}{(r_{ES}-x)^2} = \frac{m_E}{x^2}$$
$$m_S x^2 = m_E (r_{ES}-x)^2$$
$$(r_{ES}-x)^2 = \frac{m_S}{m_E} x^2$$
$$r_{ES}-x = \sqrt{\frac{m_S}{m_E}}\, x$$
$$r_{ES} = x + x\sqrt{\frac{m_S}{m_E}}$$
$$r_{ES} = x\left(1+\sqrt{\frac{m_S}{m_E}}\right)$$
$$x = \frac{r_{ES}}{\left(1+\sqrt{\frac{m_S}{m_E}}\right)}$$
$$x = \left[\frac{1.5\times10^{11}\,m}{1+\frac{1.99\times10^{30}\,kg}{5.97\times10^{24}\,kg}}\right]$$
$$x = 2.59\times10^{9}\,m$$

b) the Ship would keep moving

Chapter 17 #7

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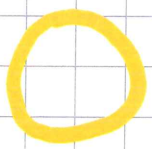

$m = 17.7\,g$ or $.0177\,kg$

$197\,g/mol$

$$\#\ of\ mol = \frac{17.7\,g}{197\,g/mol} = .0898\ mol$$

$1\ mol$ has $N_A = 6.02 \times 10^{23}\ Atoms/mol$

$$\#\ of\ Atoms = (.0898\ mol)(6.02 \times 10^{23}\ Atoms/mol)$$
$$= 5.4 \times 10^{22}\ Atoms$$

$$\#\ of\ Protons = 79(5.4 \times 10^{22}\ Atoms) = 4.27 \times 10^{24}\ protons$$

$$total\ Charge = (4.27 \times 10^{24}\ protons)(1.6 \times 10^{-19}\ C/proton)$$
$$total\ charge = 6.83 \times 10^{5}\ C$$

b) $\#\ of\ electrons = \#\ Protons = 4.27 \times 10^{24}$ //

Chapter 17 #20

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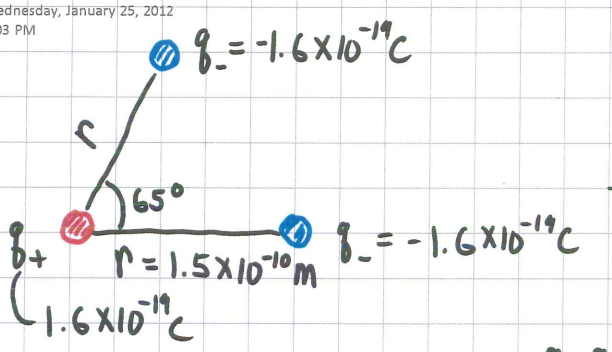

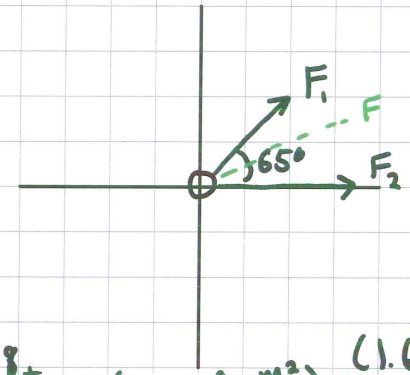

$$F_1 = F_2 = k\frac{q_- q_+}{r^2} = \left(9\times10^9 N\frac{m^2}{C^2}\right)\frac{(1.6\times10^{-19}C)}{(1.5\times10^{-10}m)^2} = 1.023\times10^{-8}N$$

$$\Sigma F_x = F_1\cos(65°) + F_2 = 1.46\times10^{-8}N$$

$$\Sigma F_y = F_1\sin(65°) + 0 = 9.27\times10^{-9}N$$

$$|F| = \sqrt{\Sigma F_x^2 + \Sigma F_y^2} = 1.73\times10^{-8}N$$

$$\theta = \tan^{-1}\left(\frac{\Sigma F_y}{\Sigma F_x}\right) = 32.4°$$

Chapter 17 #22

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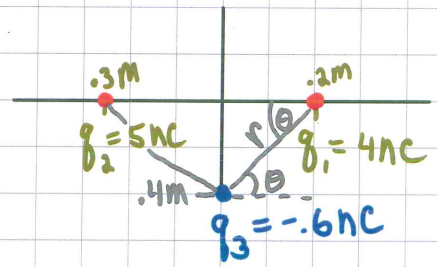
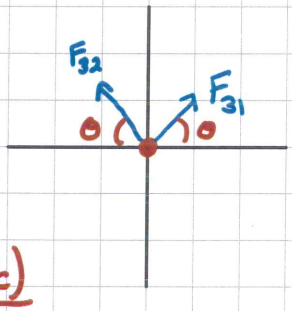


$$r = \sqrt{(.2\,m)^2 + (.4m)^2} = .447m$$

$$\theta = \tan^{-1}\left(\frac{.4m}{.2m}\right) = 63.4°$$



$$F = F_{31} = F_{32} = k\frac{q_2 q_3}{r^2}$$

$$F = \left(9X10^9 N\frac{m^2}{C^2}\right)\frac{(5X10^{-9}C)(.6X10^{-9}C)}{(.447m)^2}$$

$$F = 1.35X10^{-7}N$$

$$\Sigma F_x = 0$$

$$\Sigma F_y = F_{31}\sin(63.4°) + F_{32}\sin(63.4°)$$

$$\Sigma F_y = 2.41X10^{-7}N \text{ up}$$