Gravitational Fields Worksheet

① $F = \frac{G m_1 m_2}{r^2} = \frac{(6.67\times10^{-11})(1.8\times10^{8})(1.8\times10^{8})}{(94)^2} = \underline{245\ N}$

② $F = \frac{G m_1 m_2}{r^2} = \frac{(6.67\times10^{-11})(70\ kg)(5.98\times10^{24}\ kg)}{(6.38\times10^{6}\ m)^2} = \underline{686\ N}$

③ $F = \frac{G m_1 m_2}{r^2} = 36\ N$

$F_{new} = \frac{G(2m_1)m_2}{(3r)^2} = \frac{2}{9}\frac{G m_1 m_2}{r^2} = \frac{2}{9}(36) = \underline{8.0\ N}$

④ $F_{mars} = \frac{G(.11 m_e)m_2}{(.54 r_e)^2} = \frac{.11}{.2916}\frac{G m_e m_2}{r_e} = \frac{.11(600\ N)}{.2916} = \underline{226\ N}$

⑤ $g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11})(1.9\times10^{27})}{(7.18\times10^{7})^2} = \underline{24.6\ m/s^2}$

⑥ $F = \frac{G m_1 m_2}{r^2} = \frac{(6.67\times10^{-11})(5.9)(.047)}{(.055)^2} = \underline{6.1\times10^{-9}\ N}$

⑦ $F = \frac{G m_1 m_2}{r^2} = \frac{(6.67\times10^{-11})(1.98\times10^{30})(1.9\times10^{27})}{(7.78\times10^{11})^2}$

$= \underline{4.15\times10^{23}\ N}$

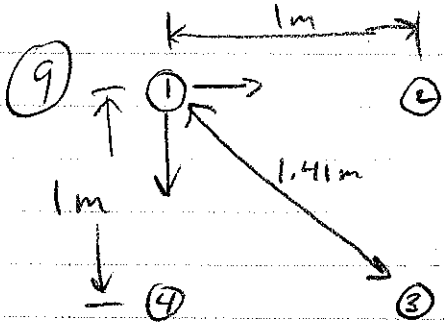
⑧ $F_1 = \frac{G m_1 m_2}{r^2}$ $\qquad m_1 = 2m_2$

$2.75\times10^{-12} = \frac{(6.67\times10^{-11})(2m_2)(m_2)}{(2.6)^2}$

$m_2^2 = .13936$

$m_2 = 0.37\ kg$

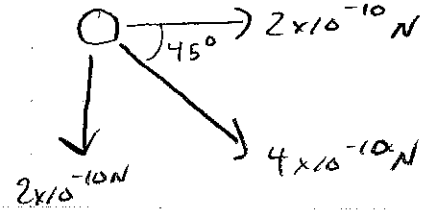
$\underline{m_1 = 0.74\ kg}$



$$F_{12} = \frac{G m_1 m_2}{r_{12}^2} = \frac{(6.67 \times 10^{-11})(3)(1)}{(1)^2} = 2.00 \times 10^{-10}\ N$$

$$F_{13} = \frac{G m_1 m_3}{r_{13}^2} = \frac{(6.67 \times 10^{-11})(3)(4)}{(1.41)^2} = 4.00 \times 10^{-10}\ N$$

$$F_{14} = \frac{G m_1 m_4}{r_{14}^2} = \frac{(6.67 \times 10^{-11})(3)(1)}{(1)^2} = 2.00 \times 10^{-10}\ N$$



Net force

X

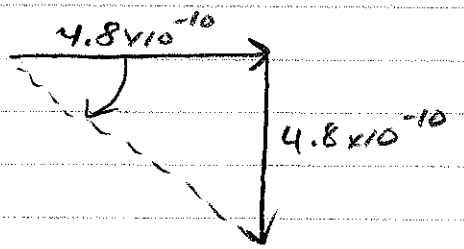
$2 \times 10^{-10} + 4 \times 10^{-10} \cos 45 =$

$4.8 \times 10^{-10}\ N$

Y

$-2 \times 10^{-10} - 4 \times 10^{-10} \cos 45 =$

$-4.8 \times 10^{-10}\ N$



$$F_{net\ on\ m_1} = \sqrt{(4.8 \times 10^{-10})^2 + (4.8 \times 10^{-10})^2}$$

$$= 6.8 \times 10^{-10}\ N$$