Gravitation/Electrostatics Problem Set

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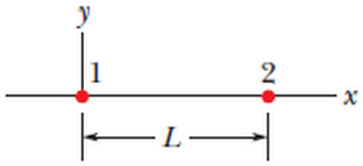
1. Suppose that the Earth retained its present mass but its radius was somehow compressed to one-sixth its present radius. What would be the value of g, the acceleration due to gravity, at the surface of this new, compact planet?

2. Generally, the electric charge of the Earth and Moon will not exceed +/- 10 C. Find the ratio of gravitational force to electrostatic force of the Earth and the Moon. What does this indicate? (mass of Earth: $5.97 * 10^{24}$ kg, mass of the Moon: $7.35 * 10^{22}$ kg)

3. In the figure, particle 1 of charge +1.0 C and particle 2 of charge 3.2 C, are held at separation L = 17.0 cm on an x axis. If particle 3 of unknown charge q3 is to be located such that the net electrostatic force on it from particles 1 and 2 is zero, what must be the x coordinate of particle 3 in centimeters?



4. In a certain binary-star system, each star has the a mass of $1.16 * 10^{30}$ kg, and they revolve about their center of mass. The distance between them is $1.6 * 10^{8}$ km. What is their period of revolution in Earth years? (Hint: think about the derivation of Kepler's Third Law)

Sources: Halliday/Resnick/Walker, Tipler