

A hydrogen atom is composed of a nucleus containing a single proton, about which a single electron orbits. The electric force between the two particles is 2.3×10^{39} greater than the gravitational force! If we can adjust the distance between the two particles, can we find a separation at which the electric and gravitational forces are equal?

1. Yes, we must move the particles farther apart.
2. Yes, we must move the particles closer together.
3. no, at any distance

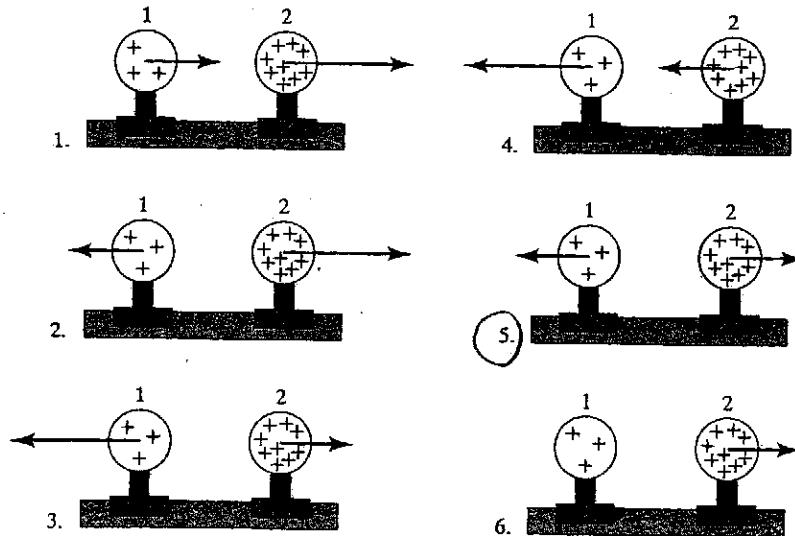
$$F_{\text{elec}} = \frac{kq_e q_p}{r^2}, \quad F_{\text{grav}} = \frac{Gm_p m_e}{r^2}$$

$$\frac{F_{\text{elec}}}{F_{\text{grav}}} = \frac{kq_e q_p / r^2}{Gm_p m_e / r^2} = \text{const}, \text{ independent of } r!$$

$$= 2.3 \times 10^{39} \leftarrow \text{a very large no.!!}$$

\Rightarrow can never have $F_{\text{elec}} = F_{\text{grav}}$

Two uniformly charged spheres are firmly fastened to and electrically insulated from frictionless pucks on an air table. The charge on sphere 2 is three times the charge on sphere 1. Which force diagram correctly shows the magnitude and direction of the electrostatic forces:



7. none of the above

Must be repulsive, and $\vec{F}_{1,2} = -\vec{F}_{2,1}$ by 3rd Law

$$|\vec{F}_{1,2}| = \frac{kQ(3Q)}{r^2}$$