

Answer on Question#65463, Physics / Astronomy | Astrophysics

693.7 N; enough

Question

Two ping-pong balls, each with a positive charge of $2.5 \times 10^{-5} C$, are located 9.0 cm apart. Determine the size of the electric force between them. Would this be enough force to support a 70 kg person against the downward force of gravity?

Solution

According to the Coulomb's law, electric force:

$$F_C = k \frac{q_1 q_2}{r^2}$$

$k \approx 8.99 \times 10^9 N m^2 C^{-2}$ – Coulomb's constant, $q_1 = q_2 = 2.5 \times 10^{-5} C$, $r = 9.0 \text{ cm} = 0.09 \text{ m}$

Then,

$$F_C = 8.99 \times 10^9 \frac{(2.5 \times 10^{-5})^2}{0.09^2} = \frac{8.99 \cdot 2.5^2}{9.0^2} \times \frac{10^9 \cdot 10^{-10}}{10^{-4}} = \frac{8.99 \cdot 6.25}{81.0} \times 10^3 \approx 693.7 \text{ N}$$

Force of gravity can be expressed as:

$$F_g = mg$$

m – mass, g – acceleration of the free fall.

If we consider person standing somewhere on Earth, then $g \approx 9.81 \text{ m s}^{-2}$

Hence,

$$F_g = 70 \cdot 9.81 = 686.7 \text{ N}$$

$F_C > F_g$, thus, such size of the electric force is sufficient to support a 70 kg person against the downward force of gravity (on Earth).

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