

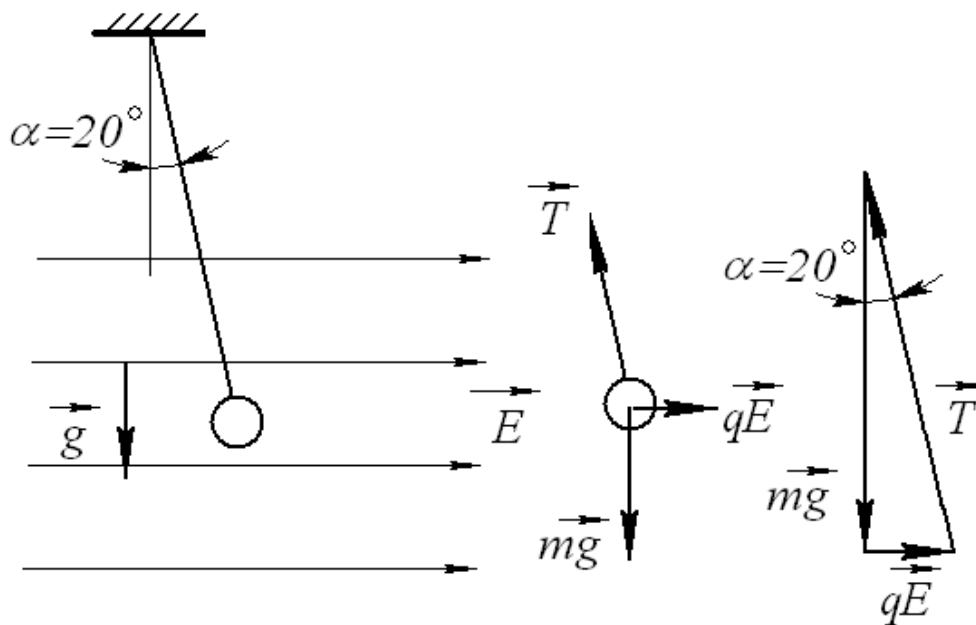
Question.

A tiny ball of mass 0.60 g is suspended from a rigid support with a piece of thread in a horizontal electric field of intensity 700 N/C. The ball is in equilibrium when the thread is inclined at an angle of 20 degrees to the vertical. What are the magnitude and sign of the charge on the ball? Take $g=9.8\text{m/s}^2$

- a. $-3.1 \times 10^{-6}\text{C}$
- b. $3.2 \times 10^{-6}\text{C}$
- c. $4.2 \times 10^{-6}\text{C}$
- d. $-4.1 \times 10^{-3}\text{C}$

Solution

Forces acting on the ball and triangle of forces are shown in Figure below: gravity $m\vec{g}$, electric force $q\vec{E}$, thread tension \vec{T} .



As can be seen from the Figure $qE = mg \cdot \text{tg} \alpha$.

$$\text{Then } q = \frac{mg \cdot \text{tg} \alpha}{E} = \frac{0.0006 \cdot 9.8 \cdot \text{tg} 20^\circ}{700} = 3.06 \cdot 10^{-6} (\text{C})$$

Answer: a. $3.1 \times 10^{-6}\text{C}$. If sign of the charge is "-", the thread will be inclined to the other side to the vertical.