Answer on Question #61327, Physics / Electromagnetism

5)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° to the vertical. What are the magnitude and sign of the charge on the ball? Take $g=9.8m/s^2$

a) $-3.1\times10^{-6}C$

b)$3.2\times10^{-6}C$

c)$4.2\times10^{-6}C$

d)-4.1×10^{-3}

Find: q – ?

Given:

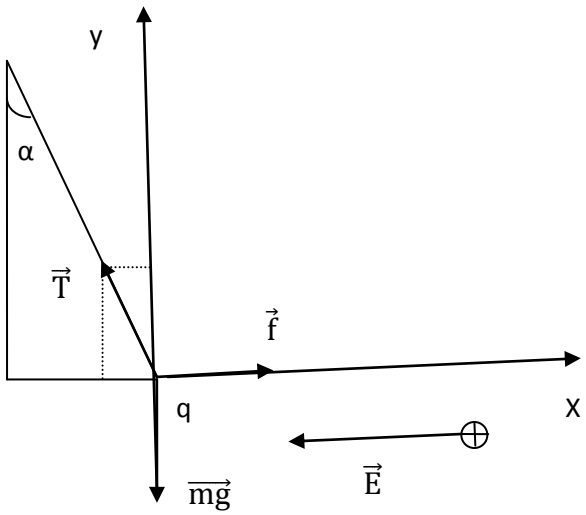
$m=0.6\times10^{-3}$ kg

E=700 N/C

α=20°

$g=9.8m/s^2$

Solution:



Consider the forces which acting on the tiny ball q.

Newton's Second Law:

$\vec{F} = m\vec{a}$ (1)

Of (1) $\Rightarrow$ $\vec{T} + m\vec{g} + \vec{f} = m\vec{a}$ (2),

where $\vec{T}$ is tension force,

$m\vec{g}$ is gravity,

$\vec{f}$ is force of electric field

Projections of the vectors:

OX: $-T\sin\alpha + f = 0$ (3)

OY: $T\cos\alpha - mg = 0$ (4)

Force of electric field:

$f = E|q|$ (5)

(5) in (3): $T\sin\alpha = E|q|$ (6)

Of (4) $\Rightarrow$ $T\cos\alpha = mg$ (7)

We divide (6) on (7) term by term:

$\tan\alpha = \frac{E|q|}{mg}$ (8)

Of (8) $\Rightarrow$ $|q| = \frac{mg\tan\alpha}{E}$ (9)

Of (9) $\Rightarrow$ $|q| = 3.1\times10^{-6}C$

From Figure $\Rightarrow$ sign of the charge: q=-3.1×10^{-6} C

Answer:

a) −3.1×10^{-6}C

6) The following are true about electric field lines except that they

a) are drawn such that the magnitude of the field is proportional to the number of lines crossing a unit area perpendicular to the lines

b) do not intersect one another

c) are discontinuous and may terminate in a vacuum

d) give the direction of motion of a unit positive test-charge under the action of the electrostatic force

Answer:

c) are discontinuous and may terminate in a vacuum