Answer on Question #43713 – Physics – Mechanics | Kinematics | Dynamics

1. Two 1.0 g beads are charged equally and placed 5.0 cm apart. When released, they begin to accelerate at 150m/s^2. What is the magnitude of the charge on each bead?

$m = 0.001 kg$	*Solution.*
$d = 0.05 m$	When released, a bead of the mass m begins to move with the acceleration a
$a = 150 m/s^2$	according the second Newton law: $ma = F$,
$q - ?$	where F is the resultant force due to the gravity and the Columb repultion.

This force is $F = -G\frac{m^2}{d^2} + k\frac{q^2}{d^2}$.

So, we can write down: $ma = -G\frac{m^2}{d^2} + k\frac{q^2}{d^2}$.

The charge on each bead is $\boxed{q = d\sqrt{\left(a + G\frac{m}{d^2}\right)\frac{m}{k}}}$.

Let check the dimension: $[q] = m\sqrt{\left(\frac{m}{s^2} + \frac{N \cdot m^2}{kg^2} \cdot \frac{kg}{m^2}\right)\frac{kg}{\frac{N \cdot m^2}{C^2}}} = C$.

Let evaluate the quantity: $q = 0.05 \cdot \sqrt{\left(150 + 6.67 \cdot 10^{-11} \cdot \frac{0.001}{0.05^2}\right) \cdot \frac{0.001}{9 \cdot 10^9}} = 2.04 \cdot 10^{-4}(C)$.

Answer: $204 mC$.