

You are part of a design team assigned the task of making an electronic oscillator that will be the timing mechanism of a small-machine. You start by trying to understand a simple model which is a charged BB moving along an axis through the center and perpendicular to the plane of a thin positively charged ring. You need to determine how the oscillation frequency of the BB depends on the size and charge of the ring for displacements of the electron from the center of the ring which are small compared to the size of the ring. A team member suggests that you first determine the acceleration of the electron along the axis as a function of the size and charge of the ring and then use that expression to determine the oscillation frequency of the electron for small oscillations.

You suggest that a computer simulation will allow you to measure the frequency, and to check the oscillation for stability. A proposed size for the ring is a radius of 2cm, a charge of 5nC. The oscillating BB would have a charge of 1nC, a mass of 0.33g, and will be much smaller than the charged ring. A reasonable time step for your simulation is 1ms. To check for stability move the BB a little bit off axis and measure the new period of oscillation.

Select one of these two methods to find the frequency of oscillation of the BB. A *short* description of your results is due next week at the start of lab.