$r_i = 10\text{mm}$

Initial

$m_c = 1g$
$q_c = 2nc$
$R_c = 1mm$
$v_{ci} = 0$

$m_D = 2g$
$q_D = -1nc$
$R_D = 1mm$
$v_{Di} = 0$

Final

$r_f = 2mm$

v_c v_D

Conserve energy $i \to f$:

$$\Delta E_{mech} = \Delta K + \Delta U = W_{nc} = 0$$

$$U_i = K\frac{q_c q_D}{r_i} \qquad U_f = K\frac{q_c q_D}{r_f}$$

So

$$(K_f - K_i) + (U_f - U_i) = 0$$

$$\left(\frac{1}{2}m_c v_c^2 + \frac{1}{2}m_D v_D^2\right) + \left(\frac{Kq_cq_D}{r_f} - \frac{Kq_cq_D}{r_i}\right) = 0$$

$$\frac{1}{2}m_c v_c^2 + \frac{1}{2}m_D v_D^2 + Kq_cq_D\left(\frac{1}{r_f} - \frac{1}{r_i}\right) = 0 \quad (1)$$

Conserve x-comp momentum $i \to f$:

$$p_{ix} = p_{fx}$$

$$0 = m_c v_c - m_D v_D$$

So $$v_D = \frac{m_c}{m_D} v_c \quad (2)$$

Subst. equ'n (2) → equ'n (1):

$$\frac{1}{2} m_c v_c^2 + \frac{1}{2} m_D \left(\frac{m_c}{m_D} v_c\right)^2 + K q_1 q_2 \left(\frac{1}{r_f} - \frac{1}{r_i}\right) = 0$$

$$m_c v_c^2 + \frac{m_c^2}{m_D} v_c^2 = 2K q_1 q_2 \left(\frac{1}{r_i} - \frac{1}{r_f}\right)$$

So:

$$v_c = \left[\frac{2K q_1 q_2 \left(\frac{1}{r_i} - \frac{1}{r_f}\right)}{\left(m_c + \frac{m_c^2}{m_D}\right)} \right]^{1/2}$$

$$= 0.0979 \text{ m/s}$$

$$\underline{v_c = 9.79 \text{ cm/s}}$$

and $$v_D = \frac{m_c}{m_D} v_c = \underline{4.90 \text{ cm/s}}$$