Electrostatics

#2

$$\overrightarrow{E} = \frac{F}{Q} = \frac{3.2\,N\,left}{2.4 \times 10^{-6}} = 1.3 \times 10^{-6}\frac{N}{C}\,right \tag{1}$$

#4

$$Q = \frac{V \cdot r}{k} = \frac{(-6.4 \times 10^4)(0.25\,m)}{9.00 \times 10^9 \frac{Nm^2}{C^2}} = 1.8 \times 10^{-6}C \tag{2}$$

#5

$$V = \overrightarrow{E} \cdot r = (1.5 \times 10^4 \frac{N}{C})(0.012\,m) = 1.8 \times 10^2\,V \tag{3}$$

#7

$$\Delta E_k + \Delta E_p = 0 \rightarrow \Delta E_k = -\Delta E_p \tag{4}$$

$$\frac{1}{2}mv^2 = -Q\Delta V \tag{5}$$

$$v = \sqrt{-\frac{2Q\Delta V}{m}} = \sqrt{-\frac{2(-3.2 \times 10^{-19}\,C)(\frac{2000\,V}{2})}{6.6 \times 10^{-27}\,kg}} = 3.1 \times 10^5\,\frac{m}{s} \tag{6}$$

#9
Rick, this one took me a while because you had a typo where you entered 180 μC, but the answer only works if that value is 18 μC.

$$F = k\frac{Q_1 Q_2}{r^2} \tag{7}$$

$$F_{CA} = (9.00 \times 10^9 \frac{Nm^2}{C^2})\frac{(2.5 \times 10^{-6}\,C)(4.0 \times 10^{-5}\,C)}{(0.36\,m)^2} = 6.\overline{9}44\,N \tag{8}$$

$$F_{CB} = (9.00 \times 10^9 \frac{Nm^2}{C^2})\frac{(2.5 \times 10^{-6}\,C)(1.8 \times 10^{-5}\,C)}{(0.12\,m)^2} = 2\overline{8}.125\,N \tag{9}$$

$$F_{net} = F_{CA} + F_{CB} = 6.\overline{9}44\,N + (-2\overline{8}.125\,N) = 21\,N\,away\,from - \tag{10}$$

#10

$$\overrightarrow{E} = \frac{kQ}{r^2} \tag{11}$$

$$\overrightarrow{E}_{q1} = \frac{(9.00 \times 10^9 \, \frac{Nm^2}{C^2})(-2.0 \times 10^-5 \, C)}{0.90 \, m)^2} = -2.\bar{2}22 \times 10^5 \frac{N}{C} \tag{12}$$

$$\overrightarrow{E}_{q1} = \frac{(9.00 \times 10^9 \, \frac{Nm^2}{C^2})(8.0 \times 10^-6 \, C)}{0.30 \, m)^2} = 8.0 \times 10^5 \frac{N}{C} \tag{13}$$

$$\overrightarrow{E}_{net} = \overrightarrow{E}_{q1} + \overrightarrow{E}_{q2} \tag{14}$$

$$\overrightarrow{E}_{net} = (-2.\bar{2}22 \times 10^5 \frac{N}{C}) + 8.0 \times 10^5 \frac{N}{C} = 5.8 \times 10^5 \frac{N}{C} \, right \tag{15}$$

#12

$$V = \frac{kQ}{r} = \frac{(9.00 \times 10^9 \, \frac{Nm^2}{C^2})(4.5 \times 10^{-4} \, C)}{0.50 \, m} = 8.1 \times 10^6 \, V \tag{16}$$

#13

$$\Delta E_p = Q \Delta V = (1.60 \times 10^{-19} \, C)(2.5 \times 10^4 \, V) = 4.0 \times 10^{-15} \, J \tag{17}$$

#14

$$Q = (10^{12} \, electrons)(-1.60 \times 10^-19 \, C) = -1.6 \times 10^{-7} \, C \tag{18}$$

$$V = \frac{kQ}{r} = \frac{(9.00 \times 10^9 \, \frac{Nm^2}{C^2})(-1.6 \times 10^{-7} \, C)}{0.40 \, m} = -3.6 \times 10^3 \, V \tag{19}$$

$$E = \frac{kQ}{r^2} = \frac{(9.00 \times 10^9 \, \frac{Nm^2}{C^2})(1.6 \times 10^2 \, C)}{(0.40 \, m)^2} = 9.0 \times 10^3 \, C \tag{20}$$

#15

$$E_p + E_k = 0 \rightarrow E_k = -E_p \tag{21}$$

$$E_p = k \frac{Q_1 Q_2}{r} = \frac{(1.60 \times 10^{-19} \, C)(1.60 \times 10^{-19} \, C)}{(1.0 \times 10^{-15} \, m)} = 2.3 \times 10^{-13} \, J \tag{22}$$