

P3323 Reading Quiz 2-3

September 2, 2016

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1. A total charge Q is uniformly distributed onto a spherical shell with very large radius $r \rightarrow \infty$. How much work is required to relocate all of the charge so that it is uniformly distributed on a much smaller sphere with radius R ?

A)

$$\frac{1}{8\pi\epsilon_0} \frac{Q^2}{R}$$

B)

$$\frac{1}{8\pi\epsilon_0} \frac{Q^2}{R^2}$$

C)

zero

D)

$$\frac{1}{8\pi\epsilon_0} \frac{Q}{R}$$

2. Two particles, each with charge q and mass m are held together by a string of length L . The string is cut and the particles fly apart due to the repulsive electrostatic force. What is the velocity of the particles when they are very far apart?

A) zero

B)

$$v = \pm \left[\frac{1}{m} \frac{1}{4\pi\epsilon_0} \frac{q^2}{L} \right]^{1/2}$$

C)

$$v = \pm 2 \left[\frac{1}{m} \frac{1}{4\pi\epsilon_0} \frac{q^2}{L} \right]^{1/2}$$

D)

$$v = \pm \left[\frac{1}{m} \frac{1}{4\pi\epsilon_0} \frac{q^2}{L^2} \right]^{1/2}$$

3. A pair of plates, area A , parallel to the x-y plane are located at $z = \pm d/2$, where $d \ll A$. There is a uniform surface charge density $\pm\sigma$ on the upper and lower plates respectively. Neglecting the fringe field at the edges of the plates, use Gauss's law to determine the electric field between the plates.

A)

$$\mathbf{E} = -\frac{\sigma}{\epsilon_0} \hat{z}$$

B)

$$\mathbf{E} = -\frac{\sigma}{2\epsilon_0} \hat{z}$$

C)

zero

D)

$$\mathbf{E} = -\frac{\sigma}{d\epsilon_0} \hat{z}$$

4. A charge $+q$ is placed just below the positively charged plate in the previous problem so that it is accelerated towards the bottom plate. How much work is done as the charge moves from $z = d/2$ to $z = -d/2$?

A)

zero

B)

$$W = -\frac{q\sigma}{\epsilon_0}$$

C)

$$W = -\frac{qd\sigma}{\epsilon_0}$$

D)

$$W = -\frac{d\sigma}{\epsilon_0}$$