P3323 Reading Quiz 2-2
August 31, 2016
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1. Consider the electric field of a point charge

$$\mathbf{E} = \frac{1}{4\pi\epsilon_0}\frac{\hat{\boldsymbol{r}}}{r^2}$$

Which of the following are true?

A)

$$\frac{\partial E_x}{\partial y} = \frac{\partial E_y}{\partial x}$$

B)

$$\frac{\partial E_y}{\partial z} = \frac{\partial E_z}{\partial y}$$

C)

$$\frac{\partial E_z}{\partial x} = \frac{\partial E_x}{\partial z}$$

D)

$$\frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z} = 0$$

E)

All of the above

F)

None of the above

2. A spherical shell of radius R carries a uniform surface charge density σ. What is the electric potential at $r < R$?

A) zero

B)

$$\frac{1}{\epsilon_0}\frac{R^2\sigma}{r}$$

C)

$$\frac{1}{\epsilon_0}R\sigma$$

D)

$$\frac{1}{4\pi\epsilon_0}\frac{\sigma}{R}$$

3. A spherical shell of radius R carries a uniform surface charge density σ. What is the force on a test charge Q at the point $r < R$?

A)

$zero$

B)

$$\frac{Q}{\epsilon_0}\frac{R^2\sigma}{r^2}$$

C)

$$\frac{Q}{4\pi\epsilon_0}\sigma$$

D)

$$\frac{Q}{4\pi\epsilon_0}\frac{\sigma}{R^2}$$

4. Consider a thin surface that is a boundary between two regions in space, the region *above* the boundary and the region *below*. The surface may or may not carry charge density σ. Which of the following is true?

A)

$$E^{\perp}_{above} - E^{\perp}_{below} = \frac{\sigma}{\epsilon_0}$$

B)

$$E^{\parallel}_{above} = E^{\parallel}_{below}$$

C)

$$\mathbf{E}_{above} - \mathbf{E}_{below} = \frac{\sigma}{\epsilon_0}\hat{\mathbf{n}}, \quad \text{where } \hat{\mathbf{n}} \text{ is the unit vector normal to the surface}$$

D)

$$V_{above} = V_{below}$$

E)

$$\frac{\partial V_{above}}{\partial n} - \frac{\partial V_{below}}{\partial n} = -\frac{\sigma}{\epsilon_0}$$

F) All of the above