Conceptual Questions

6.1 Electric Flux

1 . Discuss how to orient a planar surface of area *A* in a uniform electric field of magnitude E_0 to obtain (a) the maximum flux and (b) the minimum flux through the area.

2 . What are the maximum and minimum values of the flux in the preceding question?

3 . The net electric flux crossing a closed surface is always zero. True or false?

4 . The net electric flux crossing an open surface is never zero. True or false?

6.2 Explaining Gauss's Law

5 . Two concentric spherical surfaces enclose a point charge *q*. The radius of the outer sphere is twice that of the inner one. Compare the electric fluxes crossing the two surfaces.

6 . Compare the electric flux through the surface of a cube of side length *a* that has a charge *q* at its center to the flux through a spherical surface of radius *a* with a charge *q* at its center.

7 . (a) If the electric flux through a closed surface is zero, is the electric field necessarily zero at all points on the surface? (b) What is the net charge inside the surface?

8 . Discuss how Gauss's law would be affected if the electric field of a point charge did not vary as $1/r^2$.

9 . Discuss the similarities and differences between the gravitational field of a point mass *m* and the electric field of a point charge *q*.

10 . Discuss whether Gauss's law can be applied to other forces, and if so, which ones.

11 . Is the term $\vec{\mathbf{E}}$ in Gauss's law the electric field produced by just the charge inside the Gaussian surface?

12 . Reformulate Gauss's law by choosing the unit normal of the Gaussian surface to be the one directed inward.

6.3 Applying Gauss's Law

13 . Would Gauss's law be helpful for determining the electric field of two equal but opposite charges a fixed distance apart?

14 . Discuss the role that symmetry plays in the application of Gauss's law. Give examples of continuous charge distributions in which Gauss's law is useful and not

useful in determining the electric field.

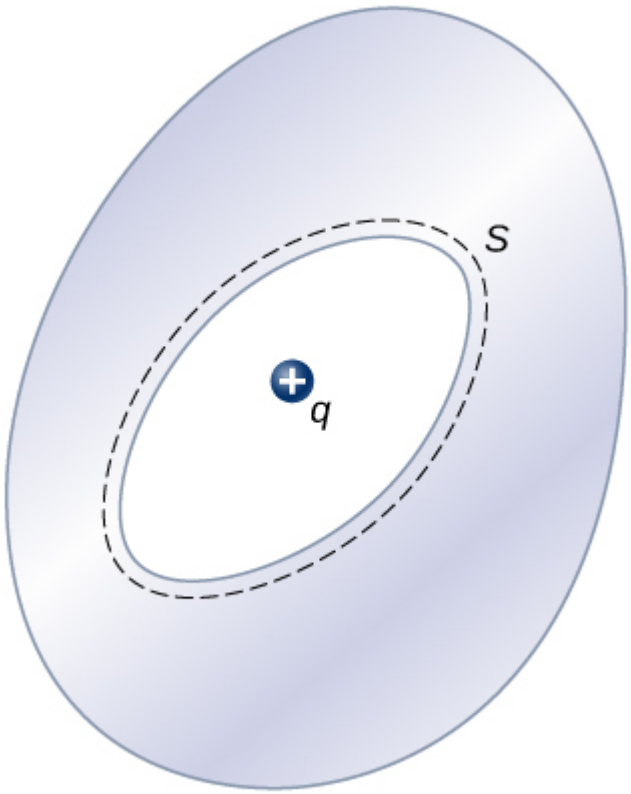
15 . Discuss the restrictions on the Gaussian surface used to discuss planar symmetry. For example, is its length important? Does the cross-section have to be square? Must the end faces be on opposite sides of the sheet?

6.4 Conductors in Electrostatic Equilibrium

16 . Is the electric field inside a metal always zero?

17 . Under electrostatic conditions, the excess charge on a conductor resides on its surface. Does this mean that all the conduction electrons in a conductor are on the surface?

18 . A charge q is placed in the cavity of a conductor as shown below. Will a charge outside the conductor experience an electric field due to the presence of q?



19 . The conductor in the preceding figure has an excess charge of $-5.0\ \mu\text{C}$. If a $2.0\text{-}\mu\text{C}$ point charge is placed in the cavity, what is the net charge on the surface of the cavity and on the outer surface of the conductor?