TERMS

Be able to define or discuss the following terms with their SI units, if any.

1. electric flux Φ_E
2. Gauss's law (Eqs. (3) and (4) below)
3. Gaussian surface

EQUATIONS

Understand the meaning and know the SI units of all the symbols in these equations—and be able to use the equations to solve problems.

1. Eqs. (22.1), (22.2), and (22.3) (three versions of the same equation)
2. Eq. (22.5)
3. The non-integral form of Gauss's law: $\Phi_E = \dfrac{Q_{\text{encl}}}{\varepsilon_0}$
4. The three integral forms of Gauss's law: $\oint \vec{E} \cdot d\vec{A} = \dfrac{Q_{\text{encl}}}{\varepsilon_0}$ **and** $\oint E \cos\phi \, dA = \dfrac{Q_{\text{encl}}}{\varepsilon_0}$ **and** $\oint E_{\perp} \, dA = \dfrac{Q_{\text{encl}}}{\varepsilon_0}$
5. $E = 0$ (in the material of a conductor for charges at rest overall)
6. $\rho \equiv \dfrac{|q|}{V}$
7. $\sigma \equiv \dfrac{|q|}{A}$
8. $\lambda \equiv \dfrac{|q|}{L}$

SKILLS

Use the material in these sections to be able to:

1. find the direction of the area vector $\vec{A}$ (or the infinitesimal area vector $d\vec{A}$) .
2. determine the correct sign for the electric flux through a closed surface.
3. use concentric spherical Gaussian surfaces for spherically symmetric charge distributions, coaxial cylindrical Gaussian surfaces for cylindrically symmetric charge distributions, and cylindrical or boxy Gaussian surfaces for infinite flat charge distributions.
4. recall that the electric field set up by positive charge is away from that positive charge and the electric field set up by negative charge is toward that negative charge.
5. when true, state that E is constant by symmetry.
6. explain the steps in derivations that use Gauss's law to find electric fields for spherically symmetric, cylindrically symmetric, or infinite flat charge distributions.
7. use $E = 0$ (in the material of a conductor for charges at rest overall) and Gauss's law to find the distribution of the charge under electrostatic conditions for conductors—including a hollow conductor with an insulated charge q within its cavity. (Explain and know for this case: there is $-q$ on the cavity wall, there is zero excess charge in the bulk of the material, and the total charge on the conductor equals $-q$ plus the charge on its outer surface.)

Great works are performed not by strength but by perseverance. Samuel Johnson