Test Next Wednesday (Sept 20)

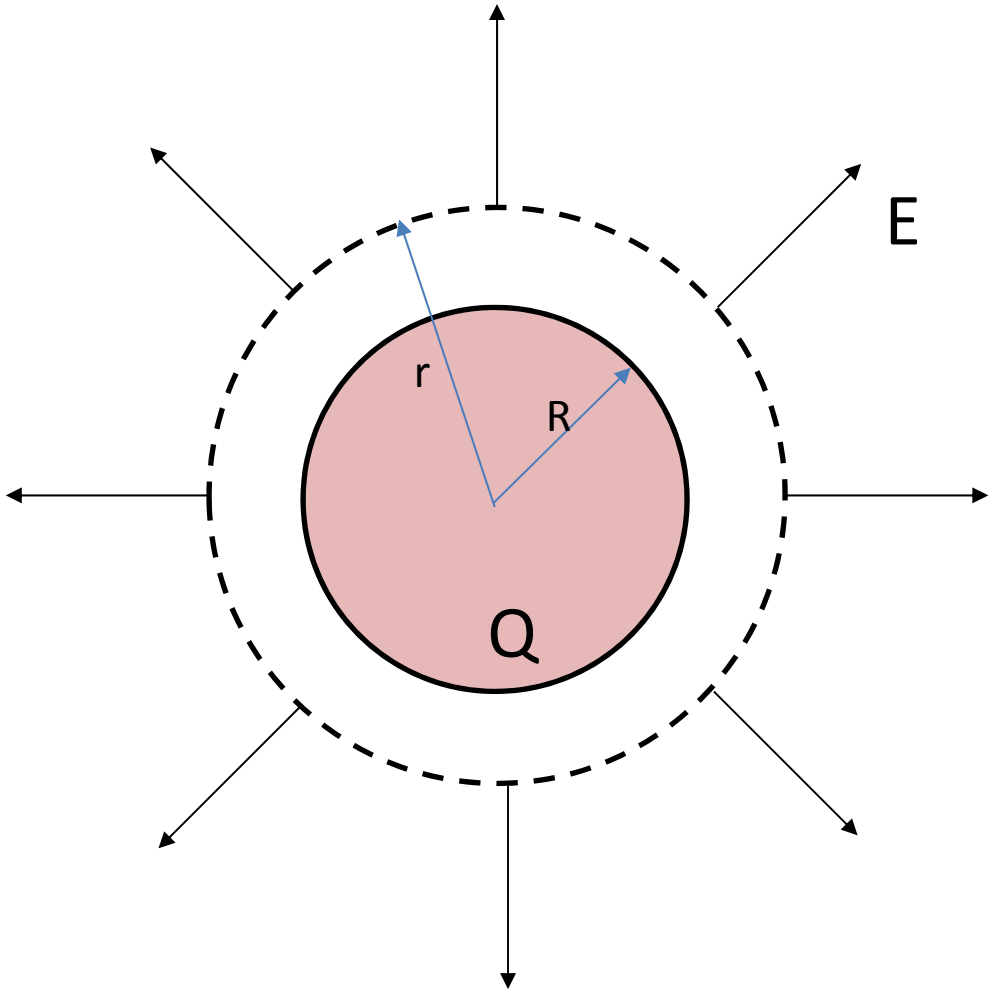
1. Chapter 5 and 6.
2. 45 minutes sharp.
3. 4 multiple choices and 2 long problems.
4. Formula sheet provided.
5. Contact me before next Monday for prearrangement if you need special accommodation.

Application of Gauss's Law

Gauss's Law can be used to calculate electric field. Practically, there are three common cases in which Gauss's Law can be applied effectively for this purpose:

1) Uniform spherical distribution of source charges
2) Uniform cylindrical distribution of source charges
3) Uniform distribution of source charges in an infinite plane.

Uniform spherical distribution



For r>R

$$\varepsilon_0 \, \Phi_E = Q \;\Rightarrow\; \varepsilon_0 \cdot E \cdot 4\pi \, r^2 = Q$$

$$\Rightarrow\; E = \frac{Q}{4\pi\varepsilon_0 \, r^2}$$

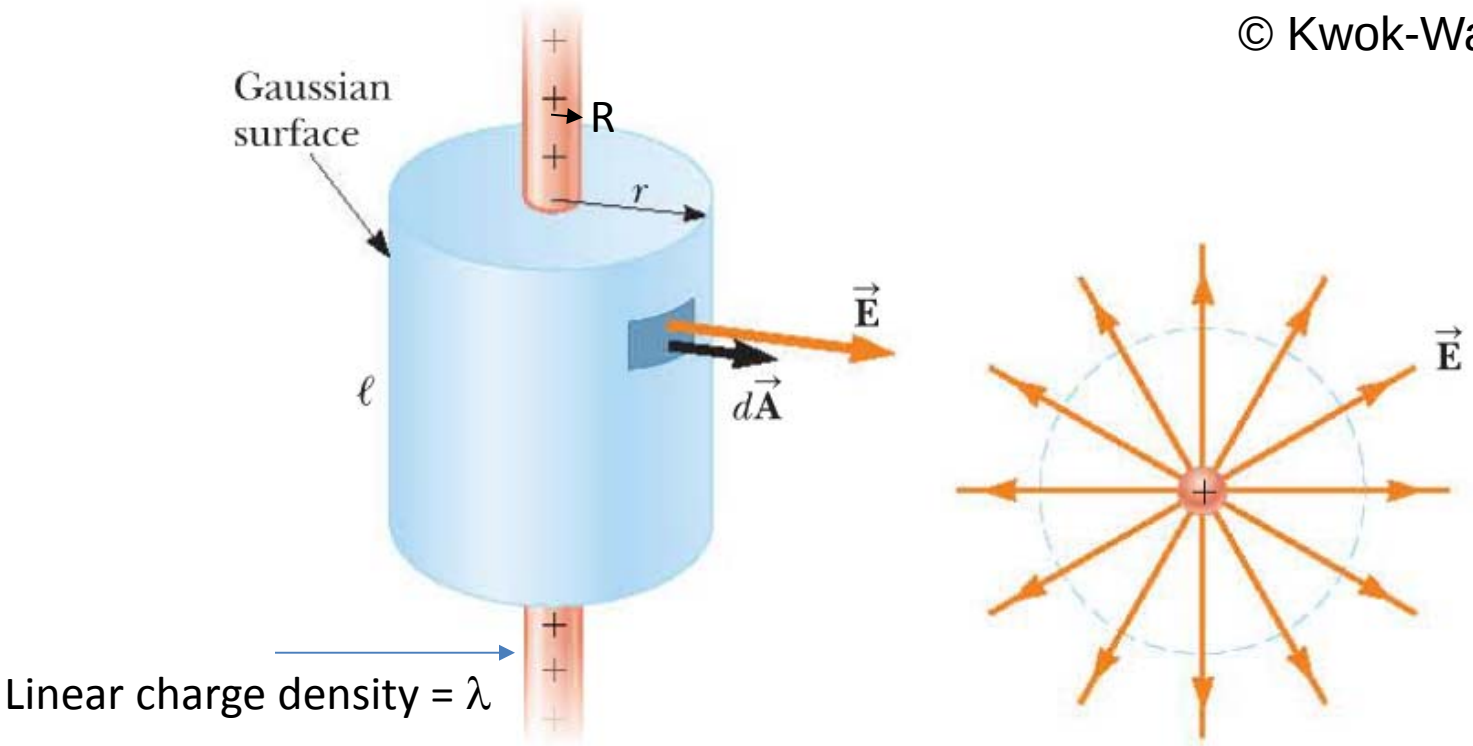
Note that point charge belongs to this case.

For r<R

Depends on the actual charge distribution.

Class 10. Application of Gauss's Law II

Uniform cylindrical (infinite long) distribution



For r>R $\varepsilon_0 \Phi_E = q_{in} \Rightarrow \varepsilon_0 \cdot E \cdot 2\pi r \ell = \lambda \ell$

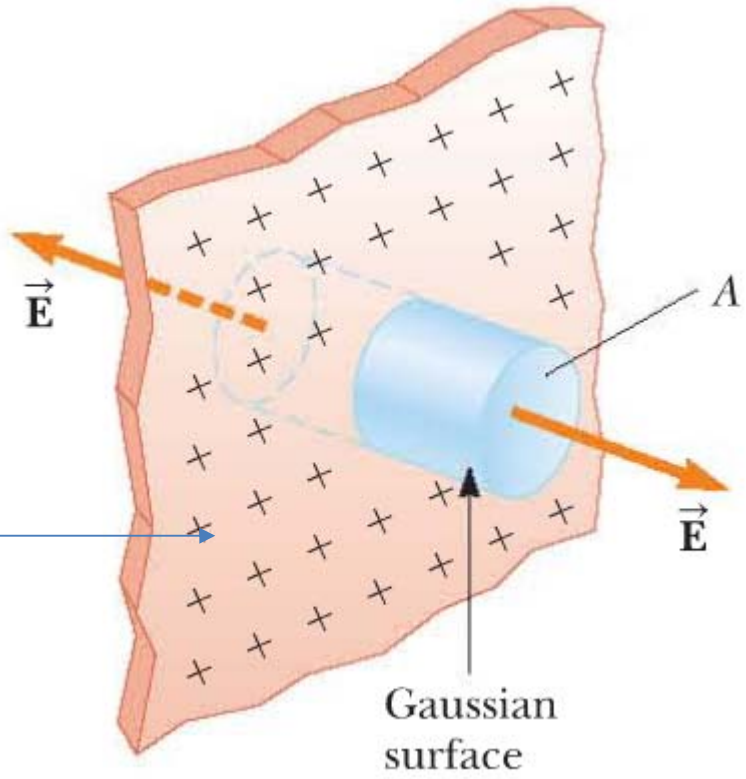
$$\Rightarrow E = \frac{\lambda}{2\pi\varepsilon_0 r}$$

Note that a line point charge belongs to this case.

For r<R Depends on the actual charge distribution.

Uniform distribution in an infinite plane

Surface charge density = σ



$$\varepsilon_0 \, \Phi_E = q_{in} \quad \Rightarrow \quad \varepsilon_0 \cdot 2 \cdot E \cdot A = \sigma \, A$$

$$\Rightarrow \; E = \frac{\sigma}{2\,\varepsilon_0}$$

Note field is constant