**PHYS1022 Summary Sheet 2**

**Gauss's Law**
*Chapter 21*
Review

- Integration (see Wolfson 9.1 on continuous distribution of matter, and Appendix A)
- Scalar (or dot) product

21.1 Electric field lines

Two ways of visualising electric fields
Point charge, radial to infinity
Distribution of charges, net field
Associate a fixed number of field lines with charge of given magnitude

21.2 Electric flux and field

Closed surfaces
Number of field lines emerging from any closed surface is proportional to net charge enclosed
Outside charges may alter shape of field but have no effect on number of field lines emerging through surface
Calculating electric flux $\Phi_{net} = \oint_S \underline{E} \cdot d\underline{A}$

21.3 Gauss' Law and the concept of imaginary closed surfaces (Gaussian surfaces)

$$\oint_S \underline{E} \cdot d\underline{A} = \frac{Q_{enclosed}}{\varepsilon_0}$$

Comparing Gauss and Coulomb

21.4 Calculating $\underline{E}$ from Gauss's Law

Choosing Gaussian surfaces and the need for symmetry
Charged sphere
Spherical shell
Line symmetry and cylindrical symmetry
Sheet of charge

21.5 Fields of arbitrary charge distributions

Using simple approximations from fields we have already found

21.6 Charges on conductors

Electrostatic equilibrium
$\underline{E}$ just outside the surface of a conductor (use Gauss to derive)
Why $\underline{E}$ is zero inside a conductor
Applications