

## PHYS1022 Summary Sheet 3

### Electric Potential

#### Chapter 22

Make use of the notes **handed out in lectures** for revision of this chapter. Establish the meaning of potential difference and be able to derive the potential at a point due to a point charge, using the electric field (or the electric force, i.e. Coulomb's law)

#### 22.1 Electric Potential Difference

The relationship between potential difference and potential energy

$$\Delta V_{AB} = V_B - V_A = \frac{\Delta U_{AB}}{q} = -\int_A^B \underline{E} \cdot d\underline{r}$$

#### 22.2 Calculating Potential Difference

The potential of a point charge

Derivation of  $V = \frac{q}{4\pi\epsilon_0 r}$ . Remember that the sign of the potential is determined by the

sign of the point charge, and make sure you understand this in terms of the definition of potential at a point (work required to bring a positive test charge from infinity to point.)

Finding potential difference using superposition

Potential along one axis due to two charges (eg dipole)

Potential energy of a system of charges

Continuous charge distributions

Charged ring

Charged disk

#### 22.3 Computing the Electric Field from the Potential

$$E_x = -\frac{\partial V}{\partial x} \quad \text{when potential } V \text{ depends only on } x$$

$$E_r = -\frac{\partial V}{\partial r} \quad \text{for spherically symmetric charge distribution}$$

#### 22.4 Charged Conductors

V inside and outside a spherical shell of charge

Compare with electric field as function of  $r$

Equipotential Surfaces