

PHYS1022 Summary Sheet 1

Electric Charge and Electric Field

Chapter 20

Note on vector notation: Wolfson uses arrows over vectors. However, the easiest method when writing vectors is to underline them, rather than draw arrows on top, and this is how they are represented below, and on the board in lectures.

The importance of electromagnetism: we are aiming for an understanding of Maxwell's Equations by the end of the course.

20.1 Electric Charge

Charge quantisation
Charge conservation

20.2 Coulomb's Law

$$F = \frac{1}{4\pi\epsilon_0} \frac{|q_1q_2|}{r^2}$$

(NB This is the *magnitude* of the force between two point charges)

$$\underline{F}_{1\text{ on }2} = \frac{kq_1q_2}{r^2} \underline{\hat{r}}$$

It is very important to understand the need for vector notation, and the direction of the forces implied by the chosen notation. Here (as in Wolfson) we use the notation such that $\underline{F}_{1\text{ on }2}$ is the force exerted **by** q_1 **on** q_2 . The unit vector $\underline{\hat{r}}$ points **from** q_1 **to** q_2 , that is from the 'source' point charge to the 'field' point charge.

20.3 The Electric Field

$$\underline{E} = \frac{\underline{F}}{q_0} \quad (\text{Definition})$$

\underline{E} due to a point charge

20.4 \underline{E} due to a system of point charges

The electric dipole

Continuous charge distributions –integration, using symmetry for simple examples

20.5 Matter in Electric Fields

Point charges

Dipoles

Conductors and insulators

Hints on Lectures and note-taking

Taking notes is an important skill. The act of writing in a lecture should help fix the material in your memory so that it is easier to recall later. What you record in a lecture gives you a reminder of what to go over later, and understand better.

In lecture:

- No need to write everything. Note main facts, ideas, results.
- Listen to what is said. It is difficult to write and listen.
- Underline or highlight important points.
- Use simple diagrams.
- Most importantly, if you don't understand something, make a note of it.

After lecture:

- Read through notes as soon as possible.
- Copy them out again, especially if messy, adding to them from textbook.
- Sort out the points you don't understand, read up, ask me, or your tutor.
- Discuss with friends, as this really helps understanding.

Summary sheets will be provided each week, and lecture slides will appear on the web page for PHYS1022.

<http://www.phys.soton.ac.uk/teach/year1/notes/phys1022/>