

STUDY GUIDE #2

In this part of the course we will study the following topics:

- Electric potential difference and electric potential for a uniform field
- Electric potential difference and electric potential for a point charge
- Calculation of the potential of a system of point charges by the principle of superposition
- Motion of a charge through a region of varying potential
- Equipotential surfaces and their relationship to electric field lines
- Capacitors as circuit elements and as devices for storing electrical energy

The electric potential provides an alternative way of thinking about electric fields that is appealing because the potential is a scalar and not a vector. Nevertheless, the potential encodes complete information about the electric field, including its vector character. Understanding how it does this is one of the major goals of this part of the course. The potential is also important because of its connection with the all-important concept of energy.

Definition 1. The potential difference, $V_B - V_A$, between two points B and A is the *negative* of the work done by the electric field on a unit positive charge that is taken from A to B.

Remark: The potential difference between two points is independent of the path along which the charge is moved between the points. The truth of this statement is not obvious. A proof of it will be given in lecture for the case of a uniform electric field. In a more advanced course in electromagnetism you would learn that this is true of all “conservative” electric fields. The notion of potential difference is so useful precisely because it is independent of the path between the points.

Definition 2. The absolute potential at any point is the potential difference between that point and an arbitrarily chosen reference point, where the absolute potential is taken to be zero.

Potential difference and potential energy of a uniform field are treated first in lecture because they are easier to understand than the same concepts for point charges.

Objective 7: Potential, potential difference and equipotentials for a uniform field

Suggested Study Procedure:

Study Ch 23.1, 2. Look particularly at pp.755-6 and Example 23-9

Suggested Problems:

Exercises 23.13, 23, 25, 44; Problems 23.55,62

Objective 8: Potential, potential difference, and energy considerations for point charges

Suggested Study Procedure:

Study Ch.23.1, 2, 3 and Ch.23.4, pp.771-773 for equipotential surfaces. Study Figs.23.24 and 23.25 closely. We won't study equipotential surfaces in much detail in this course, but this is an important concept you are bound to encounter in a more advanced course on electromagnetism..

Suggested Problems:

Exercises 23.5, 19, 24, 26

Objective 9: Capacitance, Series/Parallel Equivalence, and Energy Storage

Suggested Study Procedure:

Study Ch. 24.1, 2, 3

Suggested Problems:

Exercises 24.5, 18, 23, 25, 31; Problems 24.47, 55

Optional Reading. The notion of dielectrics will be touched on only lightly in the lectures. However those of you wanting to learn more about this important topic can read Ch.24-4.