

Physics 102b-2012 Exam 1 Coverage (Corrected)

Coverage:

Sternheim and Kane 16.1-16.7, 16.9-16.11

Class 1 (1/18/12) through class 8 (2/3/12)

Assignments 1-3

As an aid when taking the exam, you may make a sheet with up to 10 equations. You will not be allowed to consult any other materials while taking the exam. You are encouraged to consult with other students when making up your sheet, but you must write or type it yourself. You'll be provided with the values of all needed physical constants (e.g. k , ϵ_0 , e , and the mass of an electron), so you don't need to put these on your sheet.

Critical concepts

Coulomb's law

The Electric Field

Definition of the electric field in terms of the electric force

Superposition principle

Meaning of electric field lines

\mathbf{E} due to a point charge, line charge, and sheet charge

Polarization of matter in electric fields (qualitative, including why a non-uniform field is needed to produce a net force)

Two different methods for representing the field

Sketching electric field lines for a given distribution of charges

Electric fields in and around spherically symmetric charge distributions

Voltage

Definition in terms of U

Analogy with height

Superposition of voltages

How to calculate it from \mathbf{E} (*i.e.* line integral)

How to calculate \mathbf{E} from V

Fact that only voltage differences matter

Voltage due to a point charge

How to calculate voltage due to a continuous charge distribution (simple geometries only)

Relationship between \mathbf{E} and equipotential lines/surfaces

Dipoles

Definition of dipole moment

\mathbf{E} due to a dipole along its axis, and perpendicular to its axis

Force experienced by a dipole in a given electric field

Capacitors

Definition of capacitance

Parallel plate capacitors

Energy storage in capacitors

Dielectrics:

Definition of the dielectric constant

Qualitative microscopic picture of how the medium reduces the electric field

Electric field, force, voltage, and potential energy are all multiplied by $1/K$

Capacitance is multiplied by the dielectric constant

Dielectric breakdown

You are expected to be able to integrate and differentiate the following functions:

x^n (where n may be positive or negative, and may or may not be an integer), $\sin ax$, $\cos ax$, $\frac{1}{x}$, e^{ax}