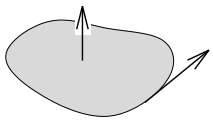
PHY 202 Final Exam Preparation

Spring semester, 2004

The purpose of this assignment is to help you prepare for the final exam. Fill in the appropriate laws or definitions; all variables must be defined somewhere in review sheet; draw a picture when appropriate (♣). Bring the completed assignment with you for use during the exam, and hand it in with your test: it will count as part of your test grade. Do not include any "extra" information on this assignment.

- Vector definitions
  - the gradient operator $\boldsymbol{\nabla} =$
  - Cross product (for combinations of $\hat{x}$, $\hat{y}$, and $\hat{z}$).
  - other right hand rule (unit normal to surface with boundary) ♣



Surface S with boundary $\mathcal{C}$. The relation between the unit normal to a surface and direction of the path on the boundary of that surface.

  - electric or magnetic flux, $\Phi_{\mathbf{E}}$ or $\Phi_{\mathbf{B}}$ ♣

- Force of $\mathbf{E}$ and $\mathbf{B}$ fields on charged particles
  - Lorenz force law (definition of $\mathbf{E}$ and $\mathbf{B}$)
  - motion of particle in a circle (vector form) and centripetal acceleration
  - force on a wire ♣

- electric and magnetic dipole moments

	electric	magnetic
definition	♣	♣
torque		
energy		

- Relation between V and $\mathbf{E}$:
  - integral form ♣
  - derivative form
- Charge/current conservation
  - definition of current (give units) ♣
  - law in sentence form
  - law in terms of ρ and $\mathbf{J}$
- **Maxwell's equations** ♣ Show any integration surfaces/volumes. Define ρ to be the charge density and $\mathbf{J}$ to be the current density. Thus, $Q = \iiint_V \rho \, dV$ is the total charge inside a volume V and $I = \iint_\sigma \mathbf{J} \cdot \hat{n} \, dA$ is the total current going through surface σ.
  - Gauß' law
    - integral form
    - derivative form

  - Ampère's law
    * static field case (older version)

    * integral form

    * derivative form

  - Gauß law for B
    * integral form

    * derivative form

  - Faraday's law
    * for a coil of wire with N loops (older version)

    * integral form

    * derivative form

- Superposition principle:
- Symmetries:
  - of $\mathbf{E}$ and V:

  - of $\mathbf{B}$:

- Charges produce electric fields

  - Coulomb's law (comes from Gauß' law) ♣

    rule for direction of **F**:

  - **E** at the surface of a conductor
  - **E** in the interior of a conductor

- Currents produce magnetic fields
  - other-other right hand rule ♣

    (The direction of the **B** field from a wire.)
  - **B** field of straight wire ♣

  - **B** field of a tightly wound wire solenoid ♣

- Circuits
  - Kirchoff's 2 laws (note the associated conservation laws)
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    *

  - definition of resistance (Ohm's law) ♣

  - definition of electric power

  - definition of capacitance ♣

    energy of a capacitor:
  - definition of (self) inductance ♣

    energy of an inductor:

- Waves
  - four kinds of polarizations of light ♣
  - spread of wave going through small hole ♣
  - interference of waves going through two holes ♣
  - definition of index of refraction
  - Snell's law ♣

- Quantum mechanics
  - **Two equations with Planck's constant** (when to use each)
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    *
  - **Relation of probabilities and wavefunctions** (see last lecture)

Fundamental laws are marked with bold face print.