

AP Physics C: Electricity and Magnetism Common Mistakes · 常见错误

Nearly every E&M point turns on choosing a surface or loop and justifying it by symmetry. Most lost marks are for applying Gauss's or Ampère's law where the symmetry does not hold, or for dropping a sign.
电磁学的关键是选对高斯面/安培回路并说明对称性; 失分多因对称性不成立或符号错误。

Gauss's and Ampère's laws

Using Gauss's law where the field is not constant over the chosen surface. The law always holds; it is only USEFUL under symmetry, and stating the symmetry is the mark.

Choosing a Gaussian surface that does not match the charge distribution's symmetry – a sphere for a line charge, a cylinder for a point charge.

Including charge outside the surface in the enclosed charge, or forgetting induced charge on a conductor.

Applying Ampère's law to a loop along which B is not constant, or forgetting that only the enclosed current counts.

Omitting the displacement current where the electric field is changing.

Fields, potential and circuits

Adding potentials as vectors or fields as scalars. Potential is scalar; field adds by components.

Dropping the minus sign in $E = -dV/dx$, so the field points the wrong way.

Assuming a conductor's interior field is non-zero in electrostatic equilibrium, or that its surface is not an equipotential.

Treating capacitance as depending on the charge stored. It depends on geometry and dielectric only.

Using steady-state reasoning during a transient. Immediately after a switch closes, a capacitor behaves as a wire and an inductor as an open circuit; long after, the reverse.

Confusing the RC and LR time constants, or using the wrong one for the circuit at hand.

Induction

Stating Faraday's law without the minus sign, and then getting the induced current's direction wrong.

Saying the induced current opposes the FIELD. It opposes the CHANGE in flux – the two differ whenever the flux is decreasing.

Forgetting that flux can change through the area or the orientation, not only through the field.

Treating an inductor as opposing current rather than opposing a CHANGE in current.