

EM Prelim

need 5 correct to pass

"correct" means correct answer written below (both formula and/or number must be correct) plus correct solution in the notebook

3 hours, 1 formula sheet, no calculators, textbooks, etc.

NAME:

A1:

A2:

A3:

A4:

A5:

A6:

A7:

A8:

1. The Earth magnetic field is $B \approx 0.5\text{G}$, while the electric field near the Earth surface is $E \approx 100\text{V/m}$. Calculate the dimensionless ratio $f = E/B$.
2. Estimate the deflection angle θ for an $E = 5\text{TeV}$ proton hitting Earth by the Earth magnetic field. (FYI: The cosmic ray shadow of the Moon is indeed magnetically displaced.)
3. Estimate the inductance L of a wedding band. In henries, please.
4. An electric dipole d is at a distance r from an electric quadrupole D . Estimate the torque on the quadrupole K .
5. A photon of energy $\epsilon = 1\text{MeV}$ is scattered by 90° by an electron at rest. Calculate the energy E of the scattered electron.
6. A non-relativistic electron with initial velocity v is scattered by an electron at rest. The impact parameter b is such that scattering angle is small. Estimate the radiated energy E .
7. There are two concentric grounded conducting spheres of radii $a < b$ and a point charge q at a distance r , $a < r < b$, from the center. Calculate the induced charges q_a and q_b .
8. Give a rough estimate for Cherenkov power P , in the visible, for a 2 MeV electron in water.