

- 1) For high-frequency applications, nonmagnetic silicon is often added to iron. What properties are improved by this addition, what is the limit in the amount of Si that is beneficial, and why? (0.5 points)
- 2) A 10nm oblate ellipsoid of Fe with 3% Si (10% reduction in saturation magnetization) is oriented such that its axis of symmetry is parallel and perpendicular to a magnetic field. Quantitatively plot the M vs H loop in each case for axial ratios of 0:1 1:1 and 10:1. Ignore crystalline anisotropy. (1.5 points)
- 3) The magnetization of a cubic ferrite, or spinel, increases with the addition of nonmagnetic Zn. Why? (0.5 points)
- 4) Graph the expected saturation magnetization vs Zn²⁺ substitution. (Note: the iron is both Fe²⁺ and Fe³⁺ (5μ_B), there are 8 formula units per unit cell with a 8.39 Å lattice parameter. (1μ_B = 0.927x10⁻²⁰ emu) (1.5 points)

