A. 10 nm of a thin film consisting of 50% Fe and 50% Ni atoms is deposited. Calculate its magnetization in μ_B/atom, emu/cm^3, and A/m. You may assume the volume of both Ni and Fe atoms is 11 Å^3. (1 point)

B. The thin film is shaped like a cross as shown on the last (tear-off) page of this test. The [100] easy axes are along **x** and **y**. In the top figure, show a zero field domain pattern that has no surface or interior poles. In the bottom figure, show a pattern that reduces the magnetoelastic energy relative to the pattern in the top figure. (1 point)

C. 5 nm of a granular antiferromagnetic material (Neel Temperature = 600 K) is deposited atop the ferromagnetic thin film. The grains are 10 nm in diameter. The uniaxial anisotropy of 10^6 ergs/cm^3 produces an exchange bias of 500 Oe. The system is cooled to 0 K under a 20 kOe field applied along **x**. Describe the magnetization in the ferromagnet after the cooling field is removed. (0.5 point)

D. If the thickness of the ferromagnetic thin film doubles, what will the exchange bias become? (0.5 points)

E. Refrigeration fails overnight and the system reaches room temperature. How does the exchange bias and domain pattern change? (1.0 points)

Note: Use the answer sheet provided for answering this problem.