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Submit to Justin by November 20

1. What is electric polarization P ? What is magnetization M ? At a fixed temperature, describe (using suitable sketches) how (a) P depends on the electric field E for a dielectric (b) How P depends on E for a ferroelectric (c) How M depends on the magnetic field H for a paramagnetic substance and (d) How M depends on H for a ferromagnetic substance.

2. Fe is ferromagnetic at room temperature, but two Fe nails do not stick to each other. Why is this ? How can you make them stick ?

3. In CGS units, the magnetic flux density B is related to the magnetic field H and the magnetization M according to $B = H + 4\pi M$. For a superconductor (a perfect diamagnet), there is no flux within the material. What value (in CGS units) must the susceptibility χ have.

4. Explain why the susceptibility *versus* temperature plots for a paramagnet, can also be used for paramagnets with ferromagnetic interactions, simply by shifting the origin on the temperature axis.

5. Have you looked at the internet for pictures of the Meissner effect ? Suggest a use for this effect (other than levitating trains).

6. Have you seen pictures of frogs floating ? Would you float in a strong magnetic field ? (Think carefully on this one ?)