LAPLACES EQN.

$\vec{J} = \sigma \vec{E}$ OHM'S LAW

$\vec{\nabla} \cdot J = 0$ MAGNETOSTATICS $\Rightarrow \vec{\nabla} \cdot \frac{\vec{E}}{\sigma} = \frac{1}{\sigma} \vec{\nabla} \cdot \vec{E} = 0$

3. I have a channel of weakly conducting material (a solid rectangular "pipe" which is very long). Outline how you would solve for the current density inside the copper if I put 4 isolated electrodes around this material with 12 V on one electrode and ground all the other sides. Assume magnetostatics and constant σ.

- Sep of varibles like example 3.3 of Griffiths

- Relaxation method as in homework 4 problem 2.

4. A bar magnet is moving at constant speed in free space toward a conducting wire loop. Explain how energy is conserved as it moves through the conducting wire loop and how you calculate it.

Reduction in kinetic energy of magnetic results in an increase in magnetic field energy &, Ohmic losses in loop.

5. Watch the two video's whose links are found on the part of the wiki devoted to this exam or search youtube for "Dr. Pepper Meets Induction Heater" and "Red-hot ice cube by induction heating." Explain the physical mechanism shown in each video.

Induced current in the can due to Faraday's law. Also a $q\vec{v} \times \vec{B}$ force on conduction electrons in can causing it to "implode" when heat causes metal to weaken.

Ice cube most likely has a metal ring frozen into it since ice will not allow currents to flow.