

## Recitation 4

In this recitation, we will look at:

- Review:
  - Types of Work: Electric and Magnetic
  - Brief Review of Tensors
  - Elastic Tensors
  - Elastic Strain Energy
  - Note: Happy Meal Deal.....
- Questions regarding homework
- Sample Problems

### Problem 1

This problem was given as a Problem Set last year.

The bulk modulus,  $K$ , of an isotropic linear elastic solid is defined by the dilation,  $\frac{\Delta V}{V_0}$ , response to hydrostatic pressure,  $P$ :

$$\frac{\Delta V}{V_0} = \frac{V - V_0}{V_0} = -\frac{P}{K} \quad (1)$$

- Typical values of  $K$  for an ionic crystal are about 100  $GPa$ .
- The electric permittivity of vacuum,  $\kappa_0$ , is  $8.85 \times 10^{-12} \frac{C^2}{Jm}$ . Typical values of the dielectric susceptibility,  $\chi$ , ( $\vec{P} = \kappa_0 \chi \vec{E}$ ), of an ionic crystal are about 50 (unitless).
- The magnetic permittivity of vacuum,  $\mu_0$ , is  $4 \pi \times 10^{-7} \frac{T^2 m^3}{J}$ . The magnetic susceptibility,  $\psi$  ( $\vec{I} = \mu \psi \vec{H}$ ), of a typical paramagnetic ionic crystal is about 10 (unitless).

Calculate all the ratios of: stored elastic energy, stored polarization energy and stored magnetic energy in a typical ionic crystal at 1  $atm$ ,  $220 \frac{V}{m}$  and in earth's magnetic field.