Homework # 2. Due: Thursday, 09/16/99

5. Calculate the electric quadrupole moment of a uniformly charged ellipsoid of revolution of semimajor axis *b* and semiminor axis *a* (Krane's problem 3.21). Before performing the actual calculation (or instead of it), try to "guess" the answer based on the consideration of dimensions and limiting cases.

6. Consider a radioactive nucleus A which decays into radioactive nucleus B which in turns decays into stable nucleus C. Suppose there are no B nuclei at t=0, but there are some nuclei A. Suppose also that in an experiment, one detects the B→C activity, while the A→B activity is not detected.
   a) Derive the time dependence of the detected activity in terms of the lifetimes τ_A, τ_B; sketch the result.
   b) Analyze the limiting cases: $\tau_A \gg \tau_B$, $\tau_A \ll \tau_B$, $\tau_A \approx \tau_B$.
   c) Will the analysis modify if the state A has other decay channels apart from A→B?

7. Krane's problem 6.18: <u>carbon dating</u>.

8. Explain the following facts:
   a) α-decay is uncommon for nuclei around A=56.
   b) Decays where a proton is emitted are much less common than α-decay.