Physics 6 **Spring 2005**

Some concepts covered since second exam

Frisch & Peierls memorandum
fission
neutrons
isotopes - 235 and 238 Uranium - separation - thermal separation
chain reaction - neutrons per fission ~= 2.3
scattering - elastic, inelastic
capture
cross section
energy - 200 MeV per breakup of U
critical radius (or mass) and mean free path
Other terms:
isotopes, curve of binding energy, mass defect
mass-energy, kinetic energy
energy units: Joule (MKS system), eV, MeV, kiloton (kT)
1 $.6\times10^{-19}$ J = 1 eV, 1 MeV = 10^6 eV, 1 kT= 4.2×10^{12} J
radiation, radioactivity, radionuclide, alpha, beta, gamma
half-life, exponential decay
activity = $(0.69/T_{1/2})$ N (N=number of decaying nuclei)
activity is in units of disintegrations per second or Becquerel (Bq)
Radiation units: Curies (1 Ci = 3.7×10^{10} decays/sec, 1 decay/sec=1 Bq), Roentgens, rads, rems (see Lecture 21)
If needed on the Final the radiation order of magnitude "Rules of Thumb" will be given:
a. 1 gram of Ra or a 1 Ci source produces 1 R per hour at 1 meter distance;
b. 1 R (of gammas) gives about 1 rem dose (1 rad is about 1 rem); but 1 R (of alphas) gives about 10 rem dose; other radiation is between these extremes;
c. 1 milliCurie of material dissolved in 1 liter of water produces 8 rem/hour (for gammas);
d. 1 rem dose increases the number of cancer deaths by 200 in a population of 1 million people;
e. [surface contamination (uniformly): 1 Ci/m^2 produces 40 rad/hr at height of 1 m] (more variable than others)
Background radiation (cosmic, surroundings) ~100 to 300 mrem/yr
Medical X-ray ~ 10-50 mrem Acceptable limits ~ 1 rem/yr
fusion, A-bomb, H-bomb
missiles Trajectories are the same as thrown objects. Recall
distance = v t for constant v (horizontal motion when acceleration is purely vertical as with gravity)
height = ½ g t^2 for falling under gravity & v = g t
delivery systems – triad, ICBM
reactor: core, fuel rods, controlled fission, control rods, moderator, boiling water reactor, pressurized water reactor, nuclear accidents, Three Mile Island (TMI), Chernobyl (see Lecture 23)

See review topics for first 2 exams. Check the solutions to the other exams also.