Quiz 1 Close Book Exam at 14:30-16:00 on April 2, 2001 (Room 32-109)

1-1: Compute the activities in Ci for 1 milli-gram of pure: a) Na-24 ($T_{1/2}$ = 14.8 h); and b) Ra-226 ($T_{1/2}$ = 1620 y).

1-2: Tc-99m (half-life = 6.00 hours) is usually used for a medical diagnostic purpose. Tc-99m is generated as the daughter product of Mo-99 (half-life = 66.0 hours) following its beta transformation. If 0.01 mCi Tc-99m is needed for a medical diagnostic purpose at the hospital, and if 132 hours elapse between shipment of the Tc-generator (= Mo-99) and the use of Tc-99m in the test, how many Bq of Mo-99 must be ordered in the shipment?

1-3: Find the uncollided and observed flux through a 10 cm Al shield. The photon source is a point isotropic with 1 MeV energy is located at the contact of shield. The source strength is 3×10^{10} photons per second. Assume that the mass attenuation factor of Al for 1 MeV photon is 0.0614 cm^2/g, the specific weight of Al is 2.7 g/cm^3 , and the exposure buildup factor is simply estimated by $B = 1+ \mu x$.

1-4: N-24 is produced in a Liquid Metal Reactor by neutron activation of Na-23 reactor coolant. Considering the neutron flux level of 1×10^{14} $n/cm^2.sec$, find the specific activity of Na-24 in the coolant (Ci/gm) during reactor operation. Assume the average radiative capture X-section of Na-23 ($\sigma_{n\gamma}$) is 0.53 b. The half-life of Na-24 is 15 hours.

1-5: Calculate the equilibrium concentration of Rn-222 ($T_{1/2}$ = 3.82 days) in a sealed room (V= 4mX10mX20m = 800 m^3) when 1 Ci of Ra-226 ($T_{1/2}$ = 1,620 years) is stored. Find the ventilation exhaust rate (m^3/hour) in order to keep the concentration of Rn-222 under $4X10^{-6}$ Ci/m^3.