CHAPTER 14 HOMEWORK

#1- $^{18}O(p,n)^{18}F$

(a) Q = M(^{18}O) + M(p) – M(^{18}F)-M(n)
= 17999160u+1.007876u-28.00038u-1.00866u) = -2.439 MeV
Qmeas = -(2.453+-0.0002) MeV

(b) Kth = |Q| {1+M(p)/ M(^{18}O) } ~ 2.439{ 1.055}MeV = 2.575 MeV

#8-
(a) $^{4}He_{2} + {}^{9}Be_{4} \rightarrow {}^{12}C_{6} + n$
Q = M(He)+M(Be) –M(C)-M(n)
= {9.012182u+4.002603u-12.000u-1.008665u} = 5.70 MeV

(b) $^{2}H_{1} + {}^{2}H_{1} \rightarrow {}^{3}He_{2} + n$
Q = {2M(H) – M(He)-M(n) } = {2(2.014102u) –3.016029u – 1.008665u)=3.27 MeV
exothermic

#11- $I = Io \exp\{-n \sigma x\}$ $n = (\rho/A) N_A$ x= 200cm
ρ=70kg/m^3 = 70000/10^6 cm^3 = .07 g/ cm^3
$I/Io = 0.8 = \exp\{-n \sigma x\}$
n = (.07 /1) 6.02x10^{23} = 4.21 x 10^{22} atoms/cm^3
$-\ln(0.8) = n \sigma x$
$\sigma = -\ln(0.8)/ n x = 0.223/[(4.21 \times 10^{22})(200)]$ cm^2
σ = 2.65 x 10^{-26} cm^2 = 0.026 b

#22-(a) $P = E/\Delta t = Q N/\Delta t$
Q = 200MeV = (2x10^8 eV) (1.6x10^{-19} J/ev) = 3.2 x 10^{-11} J
N=#atoms=(M/*A*) N_A
$P = E/\Delta t = Q (M/A) N_A/\Delta t$

$M = P A \Delta t / Q N_A$ = (10^9 J/s) (235) (24x3600) / (3.2 x 10^{-11} J) (6.02x10^{23})
M = 1054 g

(b) $M = \rho V = \rho (4/3) \pi r^3$ where ρ = 18.79 g/cm^3

r = (3M/ 4$\rho\pi$)$^{1/3}$ = (13.4) $^{1/3}$ cm = 2.37 cm
d = 4.75 cm

#53- m=75kg dose = 25rad
E = (25 rad) (10^{-2} J/kg)/ (75 kg) = 18.75 J