Assignment 4

1] $N = N_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}}$

$\frac{1}{8} N_0 = N_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}}$

$\rightarrow t = 3t_{1/2} = 15$ m

$\rightarrow t_{1/2} = 5$ minutes

2] $t_{1/2} = 5$ days

$N = N_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}}$

$\frac{1}{4} N_0 = N_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}}$

$\rightarrow t = 2t_{1/2} = 10$ days

3] $t_{1/2} = 30$ years

$N|_{t=2t_{1/2}} = N_0 (\frac{1}{2})^{\frac{2t_{1/2}}{t_{1/2}}} = \frac{N_0}{4}$

percent = %25

4] $t_{1/2} = 6{,}5$ h , $t = 4t_{1/2}$, $N_0 = 48 * 10^{32}$ atom

$N = N_0 (\frac{1}{2})^{\frac{4t_{1/2}}{t_{1/2}}}$

$= \frac{48 * 10^{32}}{16} = 3 * 10^{32}$ atoms

5] $t = 14$ min $\rightarrow N = \frac{1}{16} N_0$

$t = 4t_{1/2}$

$4t_{1/2} = 14$ min $\rightarrow t_{1/2} = \frac{7}{2}$ min

6] $t_{1/2} = 140$ days , $A = A_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}}$

$\frac{1}{4} A_0 = A_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}} \rightarrow t = 2t_{1/2} = 280$ days

7] $^{40}_{1}k \rightarrow ^{40}_{3}Ar$, $t_{1/2} = 1{,}25 * 10^9$ yr

$^{40}_{1}k : ^{40}_{3}Ar$

$\rightarrow ^{40}k = \frac{1}{4}$ of the sample

$\rightarrow \frac{1}{4} N_0 = N_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}} \rightarrow t = 2t_{1/2} = 2{,}5 * 10^9$ yr

8] $t_{1/2} = 6$ h

$A = A_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}} \rightarrow \frac{1}{100} A_0 = A_0 (\frac{1}{2})^{\frac{t}{t_{1/2}}}$

$\rightarrow \frac{t}{t_{1/2}} = \frac{\ln 100}{\ln 2} \Rightarrow t = 40$ h

9] $\frac{R_e}{R_{He}} = \frac{2{,}8 * 10^{-15}}{1{,}2 * 10^{-15} \, 4^{\frac{1}{3}}} = 1{,}47$

10] a) $ED = AD * RBE = {,}240 * 3{,}5$

$= {,}84$ Su or 84 rem

b) $AD = \frac{E}{m}$

$E = {,}240 * {,}250 = 0{,}06$ J

Assighment 4

11] $AD = \frac{E}{m} = \frac{3,3\,mJ}{55kg}$

$= 6 * 10^{-5}$ Gy

$ED = AD * RBE = 6 * 10^{-5}$ Sv

$= 6$ mrem

$\rightarrow \frac{6mrem}{26mrem} = ,23$

13] $E = nE_{neutron}$

$= 6,3 * 10^{8} * 2,6 * 10^{6} * 1,6 * 10^{-19}$

$AD = \frac{E}{m} = 4,6 * 10^{-6}$ Gy

$ED = AD * RBE = 4,6 * 10^{-5}$ Sv

$= 4,6$ mrem

15] a] $A = 37000$ decay/s $\rightarrow 37 * 10^{3} * 36 * 10^{2}$ decay/h

$\rightarrow$ decay $E = ,66$ Mev

$\rightarrow AD = \frac{E}{m} = \frac{,66Mev * 37 * 36 * 10^{5}}{60} = 2,34 * 10^{-5}$ Rad

b] $ED = AD * RBE = 2,34 * 10^{-7} * ,8$

$= 11,87 * 10^{-7}$ Sv

$= 0,0187$ mrem

12] $E = nE_{photon}$

$n = \frac{2,9 * 10^{-3}}{,5 * 10^{6} * 1,6 * 10^{-19}} = 3,625 * 10^{10}$

14] $\frac{\Delta N}{\Delta t} = 6,9 * 10^{-6} * 3,7 * 10^{10}$

$= 25,53 * 10^{4}$

$\frac{\Delta N}{\Delta t} = \lambda N$

$\lambda \rightarrow \frac{Ln2}{t_{\frac{1}{2}}} \rightarrow 272 * 24 * 3600$

$N = 8,65 * 10^{12}$

$E = N * 2,82$ Mev

$E = 3,9$ J

16] a] 60 μSv = 6 mrem

b] $AD = \frac{ED}{RBE} = 60\,\mu$Gy = 6 mrad

c] $E = AD * m = 9 * 10^{-4}$ J