Nuclear Physics - Last Problem Set 10 – Due TUESDAY 12/11

Please send your solution by email, or bring to my office before EOB on that Tuesday. Also, your participation project is DUE BY THURSDAY, 12/6

Problem 1)

How many mutually independent constants of nature are required to fully specify the electroweak interaction? List all couplings, masses and mixing angles but avoid double counting (e.g. $g$, $g'$ and $e$).

Problem 2)

Classify the following weak transitions according to their “degree of forbiddenness” (allowed, superallowed, once forbidden, etc.) and to whether they are pure Fermi, pure Gamov-Teller, or mixed (see Chapter 18.6 in Povh et al.):

$^3$H $\rightarrow$ $^3$He (g.s.)
$^{20}$F $\rightarrow$ $^{20}$Ne (g.s.)
$^{42}$Sc (g.s.) $\rightarrow$ $^{42}$Ca (g.s.)
$^{42}$Sc (7$^+$ isomer) $\rightarrow$ $^{42}$Ca (g.s.) (this is a long-lived excited state of $^{42}$Sc with total J=7 and positive parity).
$^{64}$Cu $\rightarrow$ $^{64}$Zn (g.s.)
$^{84}$Br $\rightarrow$ $^{84}$Kr (g.s.)

Problem 3)

Calculate the predicted life time $\tau$ for Tritium ($^3$H) and compare to experiment. (Use equations 16.55 through 16.60 in Povh et al. Why are they applicable here?).

NOTE: This problem requires some work – see me (early!) if you need help.