PHYSICS 722/822 - Fall Semester 2018 - ODU

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

Problem 3)

Calculate the predicted life time τ 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.