Nuclear Engineering 150 – Discussion Section
Team Exercises #3

Problem 1

A reactor is operating for a long time at some known power density P_0. Then, it instantaneously changes power to some power density P_1. One fission product of interest is ^{135}Xe, though it has a neglible yield from the initial fission reaction. ^{135}Xe precursors ^{135}Te and ^{135}I are produced with a combined yield, y, of approximately 6%, before decaying via β^- decay to ^{135}I and ^{135}Xe respectively. Find the number density of ^{135}Xe as a function of time after the power change. (For convenience, let Q_f be the energy produced in a fission reaction, and let ϕ be the flux in the reactor. Your answer may be left in terms of these variables.)

Nucleus	Half-life	Thermal σ_a
^{135}Te	19.0 s	~ 0
^{135}I	6.6 hr	~ 0
^{135}Xe	9.2 hr	2.6×10^6 barns

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Problem 2

a) Find the excitation energy in ^{236}U when a neutron with zero kinetic energy is absorbed by ^{235}U.

b) Find the excitation energy in ^{239}U when a neutron with zero kinetic energy is absorbed by ^{238}U.

c) The activation energy for ^{236}U is 6.2 MeV and the activation energy for ^{239}U is 6.6 MeV. Will fission occur in each of these cases? Identify ^{235}U and ^{238}U as fissile or fissionable and explain.

d) A ^{238}U nuclei absorbs a 2 MeV neutron and fissions into ^{132}Sn, ^{106}Mo, and a neutron. If the neutron is produced with 2.5% of the total energy released in the reaction, does it have enough energy to fission another ^{238}U atom?

Nucleus	Mass
n	1.00866492 amu
^{106}Mo	105.918137 amu
^{132}Sn	131.917816 amu
^{235}U	235.043930 amu
^{236}U	236.045568 amu
^{238}U	238.050788 amu
^{239}U	239.054293 amu

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