WS 2009/10

1) Alpha-decay: angular-momentum barrier

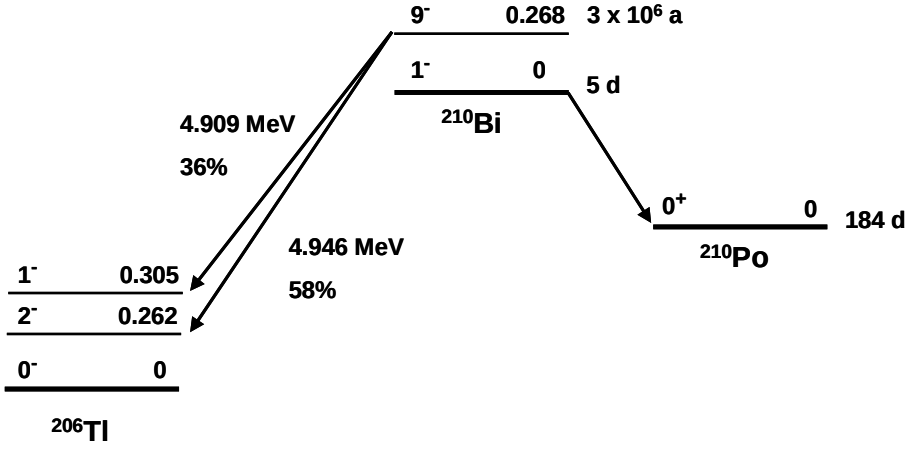
In the decay scheme below you will find an isomeric Bi-state, decaying by two different alpha branches into excited states of ^{206}Tl.

a) What are the angular momenta involved in these decays? Why is an alpha decay into the ground state missing? Support your answer by order-of-magnitudes calculations using the transition probabilities (half lives) from the graph shown in the lecture (copied below) taking into account possible angular momentum barriers.

b) The ground state of ^{210}Bi decays into ^{210}Po and into ^{206}Tl, too, but only with a fraction of 10^{-4} . Why?

c) Why are there no electromagnetic transitions seen depopulating the isomeric Bi?

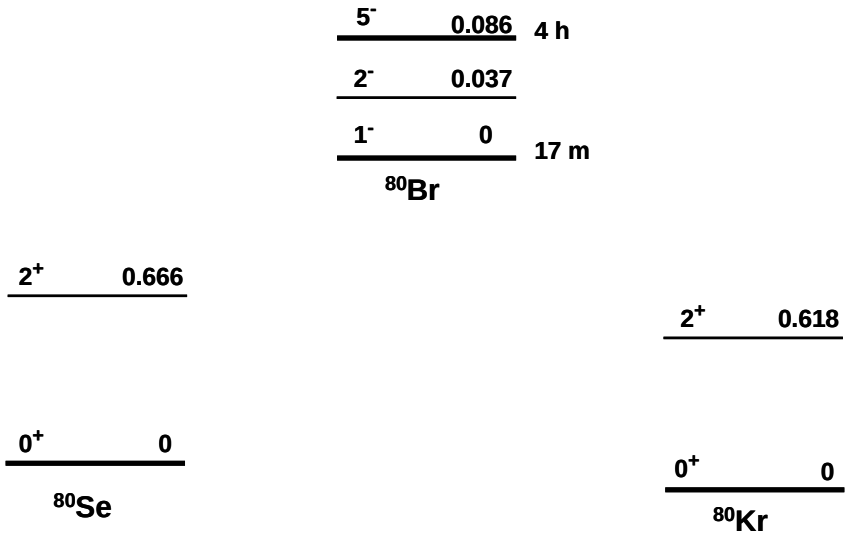
d) Explain the isomeric Bi-9^--state within the single-particle shell model.

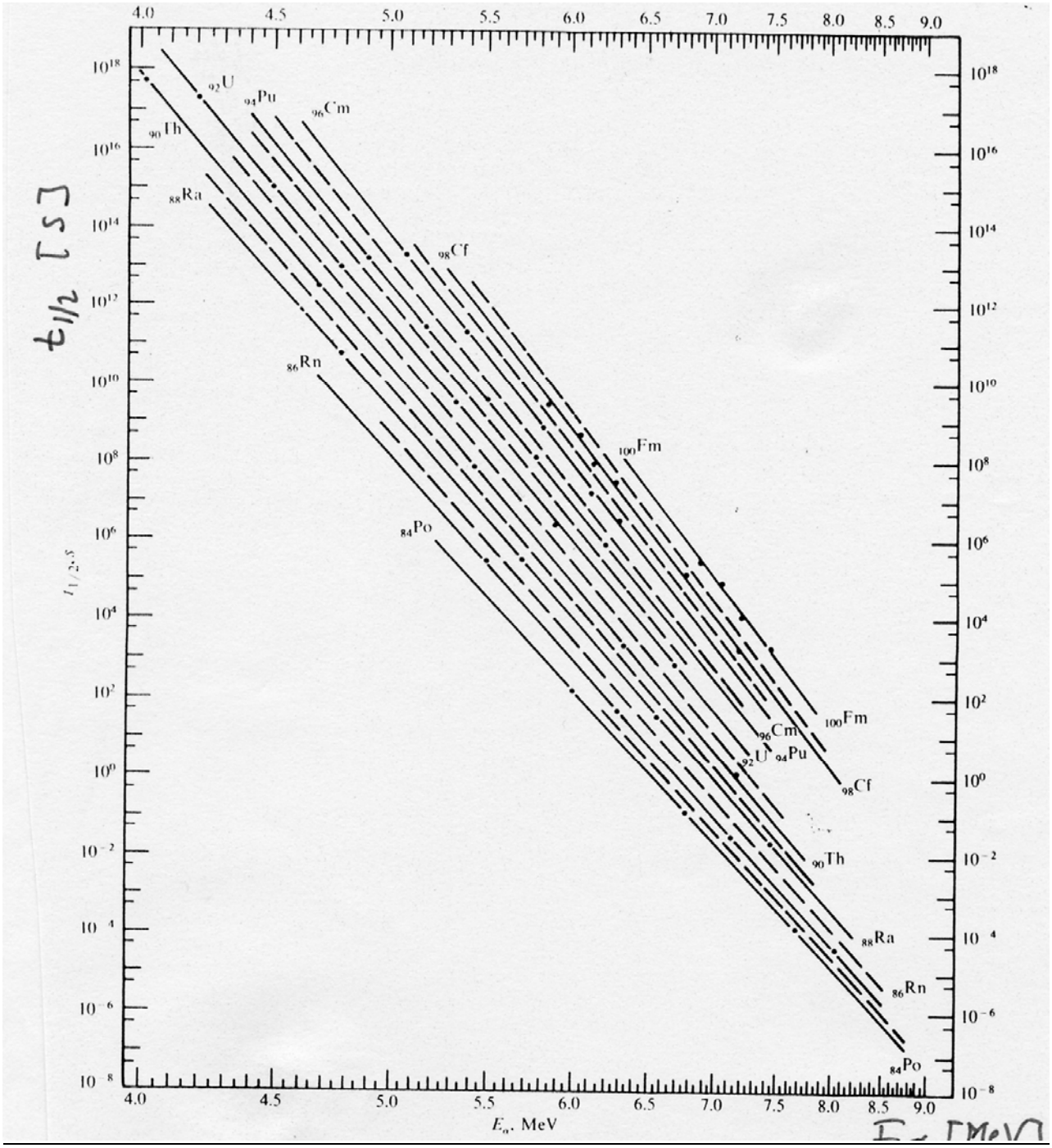


2) Beta-decay

For the A=80 – nuclei the states, given below, are known (energies in MeV, not drawn to scale):

The Q-value between the ground states of Br and Se is 1.87 MeV. Which processes (β^+, β^-, EC, γ) are possible between the shown states and nuclei? Which multipolarities are possible and could be observed? Which follow-up processes (e.g. within the atomic shell) may occur?




$t_{1/2}$ [s]
E_α, MeV
$_{92}$U
$_{94}$Pu
$_{96}$Cm
$_{90}$Th
$_{88}$Ra
$_{98}$Cf
$_{86}$Rn
$_{100}$Fm
$_{84}$Po