

(16.1) What nuclear reactions would be suitable to make gold?

The possible targets and reactions can be found by using a transparent copy of the diagram of nuclear reactions at the right in Fig. 4.7 on top of suitable a chart of the nuclides.

1.  $^{196}\text{Hg}(n,\gamma)^{197\text{m}+9}\text{Hg}(\text{EC})^{197}\text{Au}$ ; both  $^{197\text{m}}\text{Hg}$  and  $^{197\text{g}}\text{Hg}$  are produced, but both end-up as  $^{197}\text{Au}$
2.  $^{198}\text{Hg}(n,2n)^{197\text{m}+9}\text{Hg}(\text{EC})^{197}\text{Au}$ ; both  $^{197\text{m}}\text{Hg}$  and  $^{197}\text{Hg}$  are produced, but both end-up as  $^{197}\text{Au}$
3.  $^{198}\text{Hg}(\gamma,p)^{197}\text{Au}$
4.  $^{198}\text{Hg}(n,pn)^{197}\text{Au}$

etc.

However, only reaction 1 has a high reaction cross-section (120b to  $^{197\text{m}}\text{Hg}$  and 3080 b to  $^{197}\text{Hg}$ ). The high total cross section should well compensate for the low isotopic abundance of  $^{196}\text{Hg}$  (0.15%).