

TALENT6: HWK 1

Carl R. Brune

(Dated: June 11, 2019)

1. Consider the nuclear reaction ${}^3\text{H}(d, n){}^4\text{He}$. Answer the following:
 - (a) After ${}^3\text{H} + d$ and $n + {}^4\text{He}$, what particle pairs should be considered?
 - (b) Enumerate all of the possible two-particle channels with $\ell \leq 2$, in terms of α , s , ℓ , J , and π .
 - (c) Which channels would you expect to be the most important for the ${}^3\text{H}(d, n){}^4\text{He}$?

2. Consider $n - \alpha$ elastic scattering with $\ell = 0$ (single channel). Assume $a = 3.0$ fm, $B = 0$, and that the R matrix is described by a single level: $E_R = 50$ MeV and $\gamma^2 = 10$ MeV. Answer the following:
 - (a) Calculate the phase shift between zero and 20 MeV (neutron lab energy).
 - (b) This R matrix is based on the parameters given in Table 2 of Stambach and Walter, Nucl. Phys. **A180**, 225-240 (1972), [https://doi.org/10.1016/0375-9474\(72\)90166-2](https://doi.org/10.1016/0375-9474(72)90166-2). How do your results for the s -wave phase shift compare to those given in Table 3 of this paper?