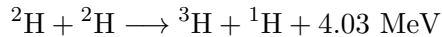
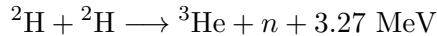


## Advanced Lab homework set 3

Download, read, and understand the material at [http://physics.csuchico.edu/ayars/427/handouts/tipler\\_radiation\\_safety.pdf](http://physics.csuchico.edu/ayars/427/handouts/tipler_radiation_safety.pdf), then answer the following questions:

1. In 1989, Stanley Pons and Martin Fleischman claimed to have achieved fusion in an electrochemical cell at room temperature. They claimed a power output of 4 W from deuterium-deuterium fusion in their electrodes. The two most likely reactions are



With 50% of the reactions going by each branch.

- (a) How many neutrons per second would we expect to be emitted in the generation of 4 W by this method?
  - (b) If 10% of these neutrons were absorbed by an 80-kg researcher standing near the apparatus, and each neutron carries an average energy of 0.5 MeV with an RBE of 4, what is the researcher's dose in rems per hour?
  - (c) How long would it take for the researcher to receive the LD50 dose of 500 rems?
2. There is a fairly "hot"  ${}^{137}\text{Cs}$  source in a lead container in the lab.
    - (a) Using a calibrated Geiger counter, determine the activity of the source. Consider distance and detector size in your calculation, and don't leave the container open longer than necessary.
    - (b) If you were standing close enough to this source to absorb 10% of the radiation emitted, how long before you reached some relevant NRC dose limit, and what would that limit be?
    - (c) Does use of this source in the lab present a health risk? Explain.
  3. Repeat problem 2 for our  $10 \mu\text{Ci } {}^{22}\text{Na}$  source. Again, clearly explain under what circumstances this source would present a health risk.
  4. From chapter 4 of Taylor, do exercises {5, 6, 11, 13, 17, 23, 24}.