

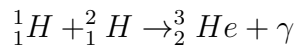
SHOW all your works. Put the answers in a BOX

NAME: _____

1 Calculate the total binding energy of tritium ${}^3_1\text{H}$. The mass of ${}^3_1\text{H}$ is 3.016049u, the mass of the proton is 1.00782u, mass of the neutron is 1.00866u. Answer in MeV.

2 Find the binding energy per nucleon of ${}^{238}_{92}\text{U}$. The mass of ${}^{238}_{92}\text{U}$ is 238.0508u, the mass of the proton is 1.00782u, mass of the neutron is 1.00866u, $c^2=931.50$ MeV/u. Answer in MeV/nucleon.

3 How much energy is released by the following fusion reaction? Answer in Mev.



The mass of ${}^1_1\text{H}$ is 1.00782u, the mass of ${}^2_1\text{H}$ is 2.0141u, and the mass of ${}^3_2\text{He}$ is 3.01603 u

4 Consider the two ways ${}^{235}_{92}\text{U}$ can undergo fission when bombarded with a neutron. In each case, neutrons are also released. Find the number of neutrons released when:

4.1 ${}^{140}\text{Xe}$ and ${}^{94}\text{Sr}$ are released as fission fragments.

4.2 ${}^{132}\text{Sn}$ and ${}^{101}\text{Mo}$ are released as fission fragments.

5 If the average energy released in a fission event is 208 MeV, find the total number of fission events required to provide enough energy to keep a 68.3 W light bulb burning for 1.7 hours.

6 Examine the following processes and state for each one:

1- If it's possible to occur (according to the following conservation laws: energy, electric charge, lepton number, baryon number). If it does not occur, state which conservation law is violate.

2- Which interaction is responsible. Assume all the decays to be at rest. The electric charges of proton and electron are not indicated. A bar over indicates the antiparticle.

6.1 $p + \bar{p} \rightarrow \pi^+ + \pi^0$

6.2 $\Sigma^- \rightarrow n + \pi^-$

6.3 $\Sigma^0 \rightarrow \Lambda + \pi^0$

6.4 $e + \bar{e} \rightarrow \mu^+ \mu^-$

6.5 $\mu^- \rightarrow e + \bar{\nu}_e$

6.6 $\Delta^+ \rightarrow p + \pi^0$

6.7 $e + p \rightarrow \nu_e + \pi^0$

6.8 $p \rightarrow e^+ + \gamma$

6.9 $n + \bar{n} \rightarrow \pi^+ + \pi^- + \pi^0$

6.10 $\pi^0 \rightarrow \gamma + \gamma$

6.11 $\Sigma^+ + n \rightarrow \Sigma^- + p$

7 Name which theories have the following features:

- A. The particles are classified as leptons, quark, vector (or gauge) bosons.
- B. There are five versions of it which are all related to another 11 dimensional theory.
- C. It is based on the idea of unifying internal and spacetime symmetries.
- D. It predicts that for every fermion must exist a corresponding boson.
- E. All the particles corresponds to different aspects of one fundamental entity.
- F. The interactions follow from requiring invariance under internal symmetries.
- G. The strong interactions is described by the use of colors.

(the same theory might be listed more than once).