natural transmutation - Uranium spontaneously decays.

$$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$$

artificial transmutation - bombardment of a stable isotope to force it to decay.

$$^{14}_{7}N + {}^{4}_{2}He \rightarrow {}^{1}_{1}p +$$

nuclear "bullet"

When the bullets are ___ charged, they are _____ by the nucleus they are bombarding. To overcome the repulsions, they must be _____ to very high speeds by _____ accelerators.

nuclear fission - Heavy nuclei are bombarded with neutrons and split.

$$^{1}_{0}n + {}^{235}_{92}U \rightarrow \underbrace{{}^{142}_{56}Ba + {}^{91}_{36}Kr + 3({}^{1}_{0}n)}_{} + E$$

Mass of particles produced is slightly _____ than the mass of the reactants. This mass is converted into _____. (E =)

critical mass: _____ mass of _____ material required

for a _____ _____

nuclear reactors: control fission _____ reactions to produce energy

dangers:

nuclear fusion - combination of _____ nuclei into _____ with release of _____

$$^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}\underbrace{He + {}^{1}_{0}n}_{} + E$$

Mass of particles produced is much _____ than the mass of the _____. This _____ is converted into energy. (E =)

On back, list advantages of and problems with using fusion as an energy source.