STE Pretest 2.3 part 2 (on web site, scroll past questions to see the answers)

1. Given:

$$^{22}_{11}\text{Na} \rightarrow \,^{22}_{10}\text{Ne} + e^{+} + \nu_e$$

$$^{22}_{11}\text{Na} + e^{-} \rightarrow \,^{22}_{10}\text{Ne} + \nu_e$$

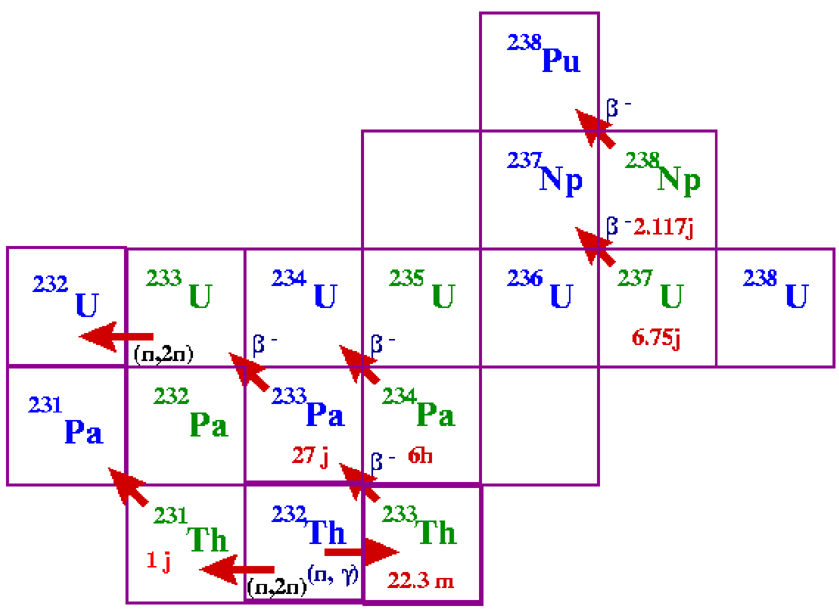
   a) What particle is being emitted by ^{22}Na in the first reaction? What transformation is taking place in the nucleus?

   b) What particle is being absorbed by the second equation?

   c) How do you know these are not chemical reactions?

2. a)If a nuclear reaction destroys the mass equivalent of 2.8 X10^{-7} moles of ^{2}H, how much energy is released? (E =mc^2 where m must be in kg and c = 3.0 X 10^8 m/s.) **WON'T BE ON TEST**

b) When ^{2}H reacts, one of the products is helium. Is this fusion? Or fission?



3. Use the following diagram to write **three** balanced nuclear equations involving ^{233}U, ^{238}Np and ^{231}Th.

Answers

$$^{22}_{11}\mathrm{Na} \rightarrow {}^{22}_{10}\mathrm{Ne} + e^{+} + \nu_e$$

$$^{22}_{11}\mathrm{Na} + e^{-} \rightarrow {}^{22}_{10}\mathrm{Ne} + \nu_e$$

a) What particle is being emitted by ^{22}Na in the first reaction? What transformation is taking place in the nucleus?

A positron is being emitted. A proton is being lost and converted into a neutron and a positron. Notice that the mass number does not change since a neutron takes the place of a proton:

$$^{1}_{1}p \rightarrow {}^{1}_{0}n + {}^{0}_{1}e$$

b) What particle is being absorbed by the second equation?

A beta particle.

c) How do you know these are not chemical reactions?

Elements are changing into different elements.

2. a) If a nuclear reaction destroys the mass equivalent of 2.8 X10^{-7} moles of ^{2}H, how much energy is released? (E =mc^{2} where m must be in kg and c = 3.0 X 10^{8} m/s.)

c = 3.0 X 10^{8} m/s

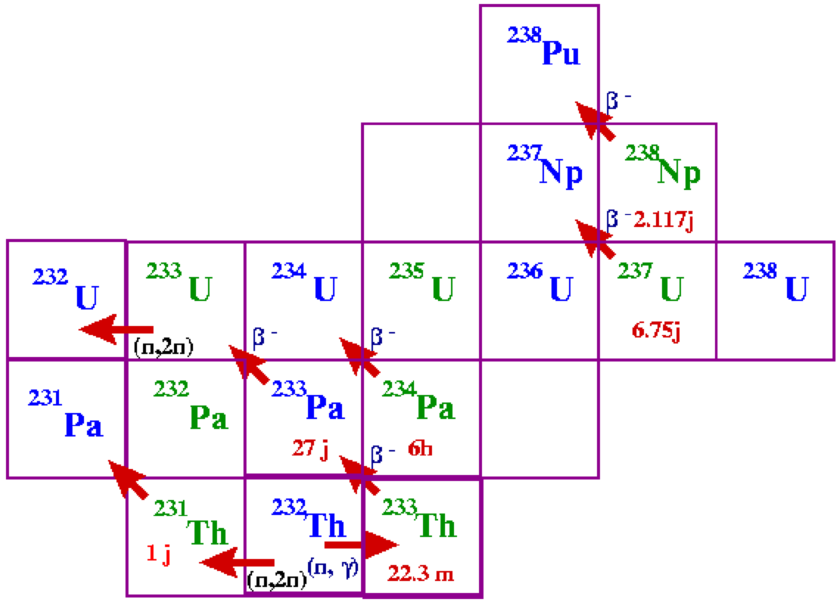
a. 2.8 X10^{-7} moles (2.0 g/mole) = 5.6 X10^{-7} g

5.6 X10^{-7} g (1kg/1000 g) = 5.6 X 10^{-10} kg

E = mc^{2} = 5.6 X 10^{-10} kg(3.0 X 10^{8} m/s)^{2} = 5.0 X 10^{7} J, (2 sig figs) enough energy to power your computer for almost 70 hours---not bad from such a small amount of hydrogen.

b) When ^{2}H reacts, one of the products is helium. Is this fusion? Or fission?

fusion



3. Use the following diagram to write **three** balanced nuclear equations involving ^{233}U, ^{238}Np and ^{231}Th.

$$^{238}_{93}Np \rightarrow \, ^{238}_{94}Pu + \, ^{0}_{-1}e$$

$$^{233}_{92}U \rightarrow \, ^{232}_{92}U + \, ^{1}_{0}n$$

$$^{231}_{90}Th \rightarrow \, ^{231}_{91}Pa + \, ^{0}_{-1}e$$