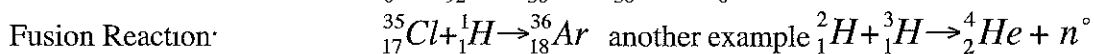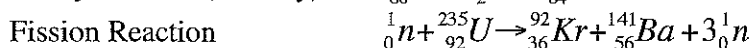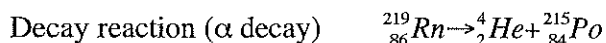Name: _____   Period: _____

There are two types of nuclear reactions. Fission, where a nucleus breaks into two or more pieces, and fusion where two or more nuclei combine to form a new element. In nuclear reactions, only the nucleus is involved. Electrons are ignored. Some atomic nuclei are inherently unstable and spontaneously change or "decay". There are four types of decay:

Type	Symbol	Charge of particle	Mass(AMU)	Effect on Atomic #	Effect on Atomic Mass	Strength
Alpha	α	+2 (He nucleus)	4	decrease by 2	decrease by 4	Stopped by paper
Beta- e- emission	β- electron	-1	0	increase by 1	0	Aluminum Foil
Beta+ e- capture	β+ Positron	+1	0	decrease by 1	0	Aluminum Foil
Gamma	γ	none	none	none	none	Lead

The net result of α, β- or β+ decay is a new element. In b- decay, a neutron decays into a p+ and an e- which is then ejected. In β+ decay a p+ captures an e- and transforms into a neutron. But despite the nature of the reaction the law of conservation of matter still applies and the equations are balanced the same way. Note α particle is a helium nucleus!
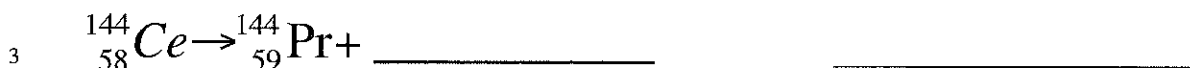
Another type of reaction occurs when something impacts a nucleus. These reactions result either in the nucleus splitting (fission) or the combination of two or more nuclei to form a third, different nucleus (fusion).

Balancing Nuclear Equations. Matter must be conserved including all p+ & n°. Example:

Decay reaction (α decay) $^{219}_{86}Rn \rightarrow ^{4}_{2}He + ^{215}_{84}Po$

Fission Reaction $^{1}_{0}n + ^{235}_{92}U \rightarrow ^{92}_{36}Kr + ^{141}_{56}Ba + 3^{1}_{0}n$

Fusion Reaction: $^{35}_{17}Cl + ^{1}_{1}H \rightarrow ^{36}_{18}Ar$ another example $^{2}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He + n°$

Practice

Fill in the missing symbol and name the reaction:

1     $^{3}_{1}H \rightarrow$ _____ $+ ^{0}_{-1}e$ _____

2     $^{232}_{92}U \rightarrow ^{228}_{90}Th +$ _____   _____

3     $^{144}_{58}Ce \rightarrow ^{144}_{59}Pr +$ _____   _____

4     $^{65}_{30}Zn \rightarrow$ _____ $+ ^{0}_{+1}e$ _____

5     $^{40}_{19}K \rightarrow ^{40}_{18}Ar +$ _____   _____

6. $^7_4Be \rightarrow \, ^7_4Be +$ _____   _____

7. $^1_0n + \, ^{235}_{92}U \rightarrow$ _____ $\rightarrow \, ^{141}_{55}Cs + \, ^{92}_{37}Rb +$ _____   _____

8. $^{222}_{86}Rn \rightarrow$ _____ $+ \, ^4_2He$ _____

9. $^{129}_{53}I \rightarrow \, ^{129}_{54}Xe +$ _____   _____

10. $^{239}_{94}Pu \rightarrow$ _____ $+ \, ^4_2He$ _____

11. $^{15}_8O \rightarrow \, ^{15}_7N +$ _____   _____
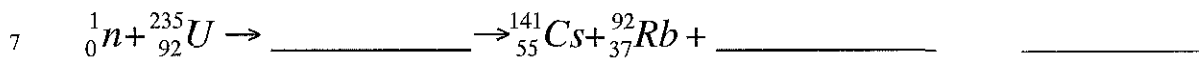
12. Write a balanced nuclear equation for each decay process indicated.
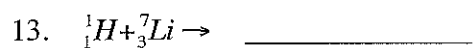   a. The isotope Th-234 decays by an alpha emission.

    b. The isotope Fe-59 decays by a beta emission.

    c. The isotope Tc-99 decays by a gamma emission.

    d. The isotope C-11 decays by a electron capture.

Balance these equations: Note ^4_2He is the only stable isotope of helium.

13. $^1_1H + \, ^7_3Li \rightarrow$ _____   14 $^7_4Be + n° \rightarrow$ _____H + _____He

15.   What is the balanced nuclear equation for the reaction of curium-246 with carbon-12 to produce nobelium-254 and four neutrons?

16.   What is the balanced nuclear equation for the reaction of californium-250 with boron-10 to produce lawrencium-258 and two neutrons?