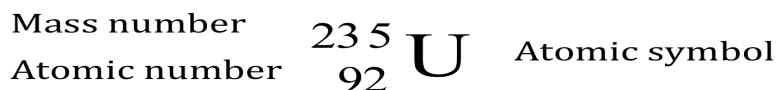


## Nuclear chemistry help sheet

### 1. Atomic Number and Mass Number

- a. Atomic Notation – commonly used to specify the number of protons and neutrons in the atom



- b. Atomic Number – the number of protons  
 c. Mass Number – the number of protons + neutrons  
 d. Number of neutrons = mass number – atomic number  
 e. Isotopes – atoms of an element that have different number of neutrons.

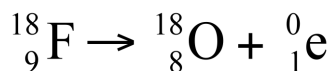


### 2. Common forms of radioactive decay

Decay Type	Particle	Particle Mass	Particle Charge	Change in mass number	Change in Atomic number
Alpha	${}^4_2\text{He}$ or ${}^4_2\alpha$	4	2+	Decreases by 4	Decreases by 2
Beta	${}^0_{-1}\beta$ or ${}^0_{-1}e^-$	0	1-	No change	Increases by 1
Positron	${}^0_{+1}e$ or ${}^0_{+1}\beta$	0	1+	No change	Decreases by 1
Electron Capture	${}^0_{-1}\beta$ or ${}^0_{-1}e^-$	0	1-	No change	Decreases by 1
Gamma	${}^0_0\gamma$	0	0	No Change	No Change

### 3. Balancing nuclear equation

- a. Sum of reactants mass = sum of products mass  
 b. Sum of reactants atomic numbers = sum of product atomic numbers  
 c. Elements may change  
 d. Example:



### 4. Half-lives and isotopic dating

- a. Radioactive decay follows first order kinetics (see kinetics handout).  
 b. Half-life is characteristic of each isotope  
 c. Relative abundance is used estimate the age of objects
  - i. Age of rock – U-235 – half-life of 4.5 billion years
  - ii. Organic materials in archeological sites – C-14 – half-life of 5730 years - Dates between 500 and 50, 000 years old
  - iii. Age of wines – H(T)-3 – half-life of 12.26 years – dates up to 100 years

### 5. Fusion, Fission, Transmutation

- a. Fusion – smaller atoms come together to form larger atoms  
 b. Fission – larger atoms break apart to form small atoms  
 c. Transmutation (artificial) – elements are converted from one to another