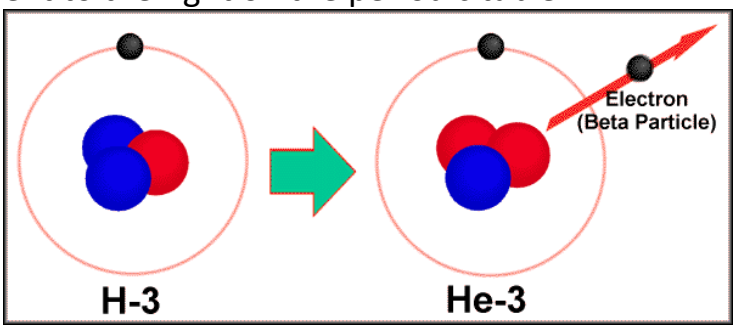
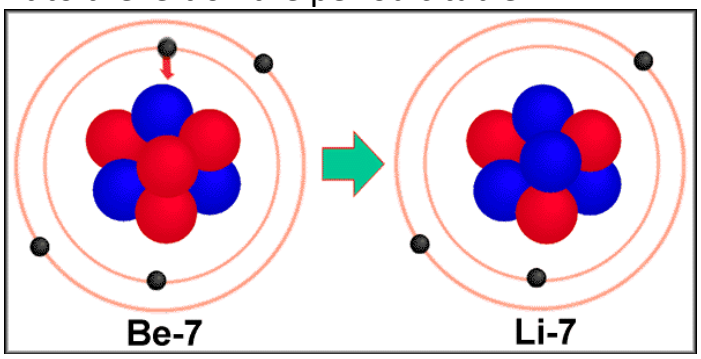
3 ways to decay isotopes

1. **Beta decay:** neutron turns into a proton and an electron.
   - Movement to the right on the periodic table



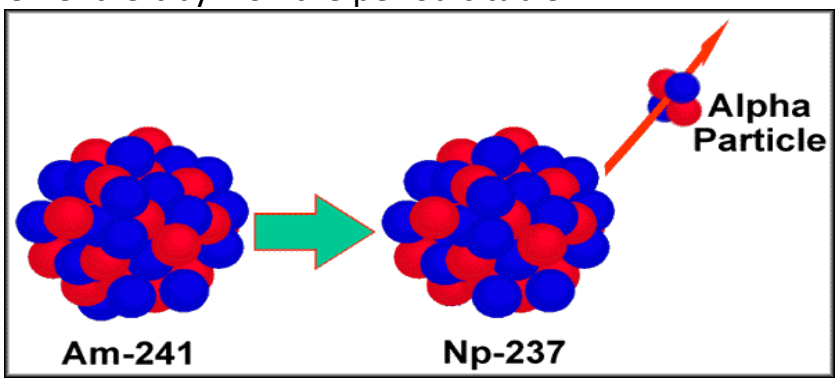
http://library.thinkquest.org/3471/radiation_types_body.html#alpha

2. **Electron capture:** Proton and electron turn into neutron
   - Movement to the left on the periodic table.



http://lhs2.lps.org/staff/sputnam/chem_notes/electron_capture.gif

3. **Alpha decay:** (only for heavy elements)
   - Loss of atomic mass (2), 2 protons, 2 neutrons, 2 electron
   - Movement left by 2 on the periodic table



http://library.thinkquest.org/3471/radiation_types_body.html#alpha

- Some heavy elements don't become stable until they decay several times
- Radioactive atoms decay at an exponential rate.
- Different isotopes decay at different rates

Comparing decay rates

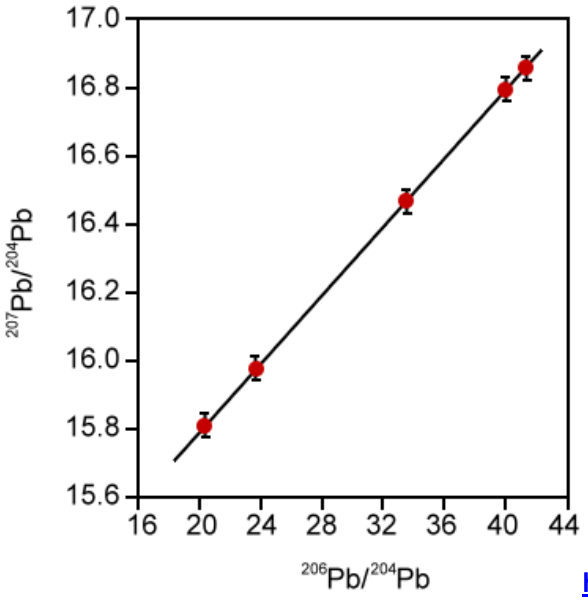
- **Half-life:** time it takes for half of the parent isotopes to convert into daughter isotopes
    - No change in the number of isotopes
    - Change in identity
    - Key to dating: Ratio of daughter/parent
    - 1 HL = 1/1 = 1 (isochron Slope)
    - 2 HL = 3/1 = 3 (isochron Slope)
    - 3 HL = 7/1 = 7 (isochron Slope)
    - 4 HL = 15/ 1 = 15 (isochron Slope)

What are we dating?

- Time since the sample become a closed system
    - Allowed atoms to go in and out
        - Example: igneous rock = liquid stage → solid stage
    - **Assumptions**
        - System has closed from the start
        - No daughter in initial sample
        - There is a robust way of correcting the initial daughter
        - The decays constants are known accurately
            - Concentration of daughter / parent isotopes are correct
- Sedimentary rock is hard to date, made of multiple types of rock, with multiple ages.

Isochron graph

- Slope = daughter / parent ratio



http://goodprovenance.com/robimages/isochron.gif