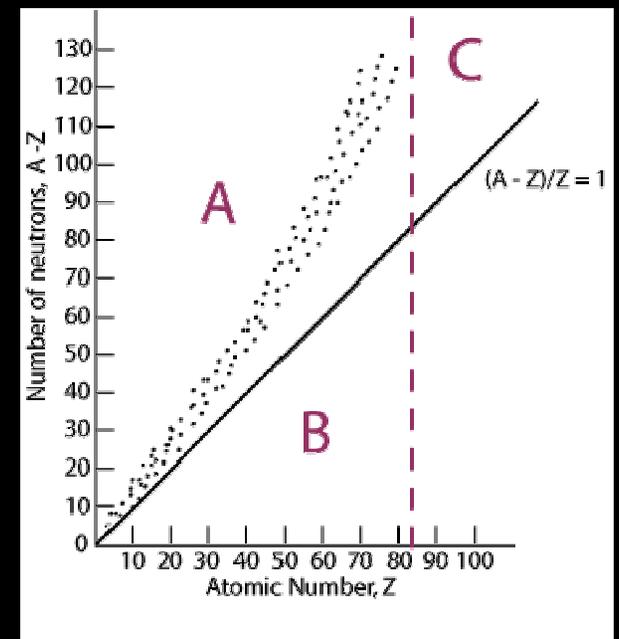


# 25.2 Nuclear Transformations

- More than 1500 **types** of nuclei are known, only 264 are stable and do not decay
- Stability **depends** on neutron to proton ratio
- The dots show stable ratios
- Called the band of stability



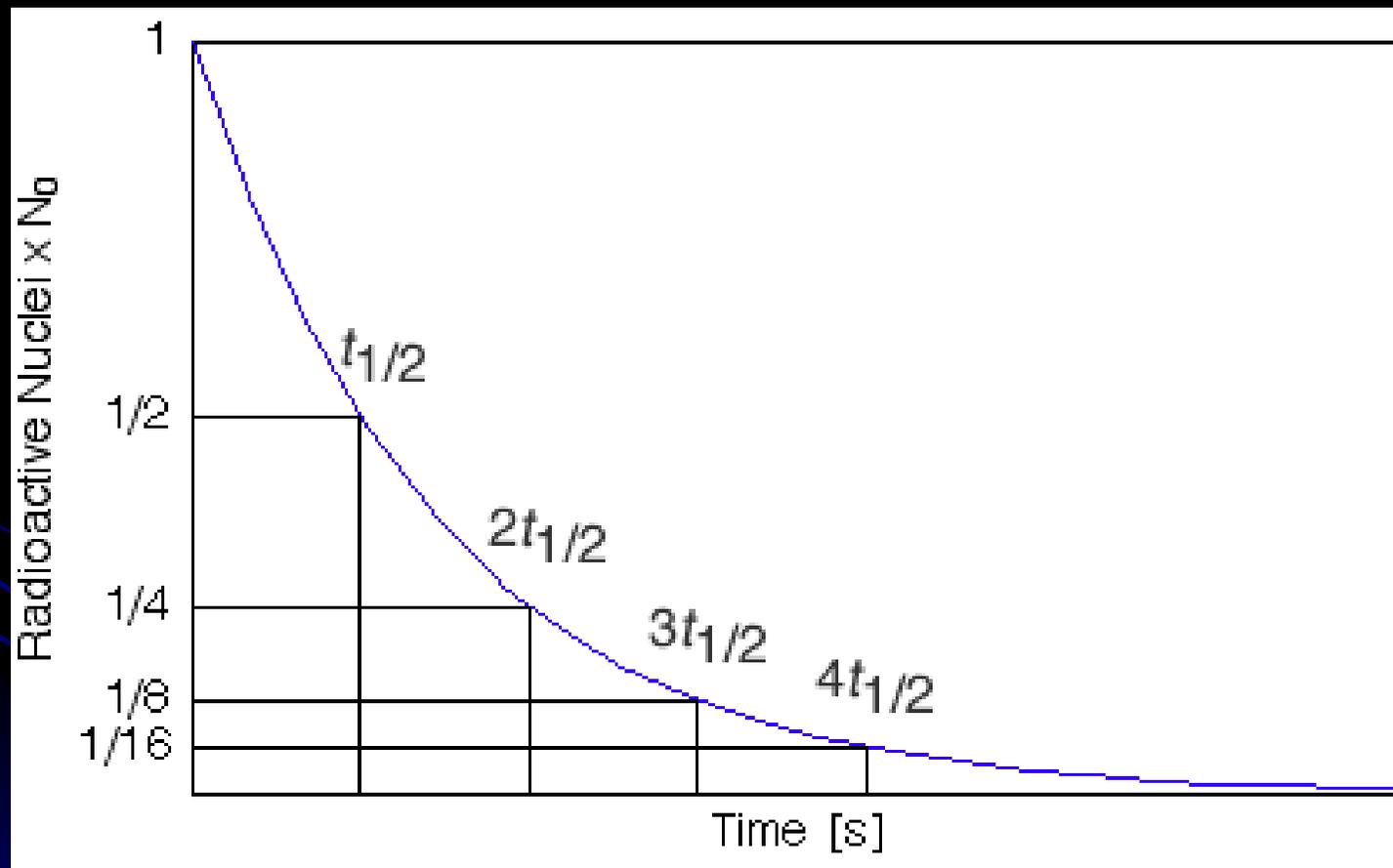
## 25.2 Decay

- The neutron to proton ratio also **determines** the type of decay
- Some nuclei emit **positrons**
- A positron has the mass of an electron, but a **positive** charge
- Shown as  ${}^0_{+1}e$
- See table 25.2 on page 804

## 25.2 Half – Life

- Half–life ( $t_{1/2}$ ) is the time **required** for half of the nuclei of a radioisotope to decay
- After each half–life,  $\frac{1}{2}$  of the **radioactive** atoms will have **decayed** into atoms of a new element
- $\frac{1}{2}$  lives can be a **fraction** of a second or billions of years
- Table 25.3 on 805 shows the  $\frac{1}{2}$  life of common radioisotopes

# Decay Curve for a Radioactive Element



# Half-Life Practice

- The half life of **Carbon-14** is 5730 years, if you start with  $2.00 \times 10^{-12}$  g, how long is 3 half-lives? How much is left after 3 half-lives?
- A) 3 half lives =  $3 \times 5730 = 17,290$  years
- B) remaining mass =
  - $2.00 \times 10^{-12} \text{ g} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = 0.250 \times 10^{-12} \text{ g}$
  - $= 2.50 \times 10^{-11} \text{ g}$

## 25.3 Fission

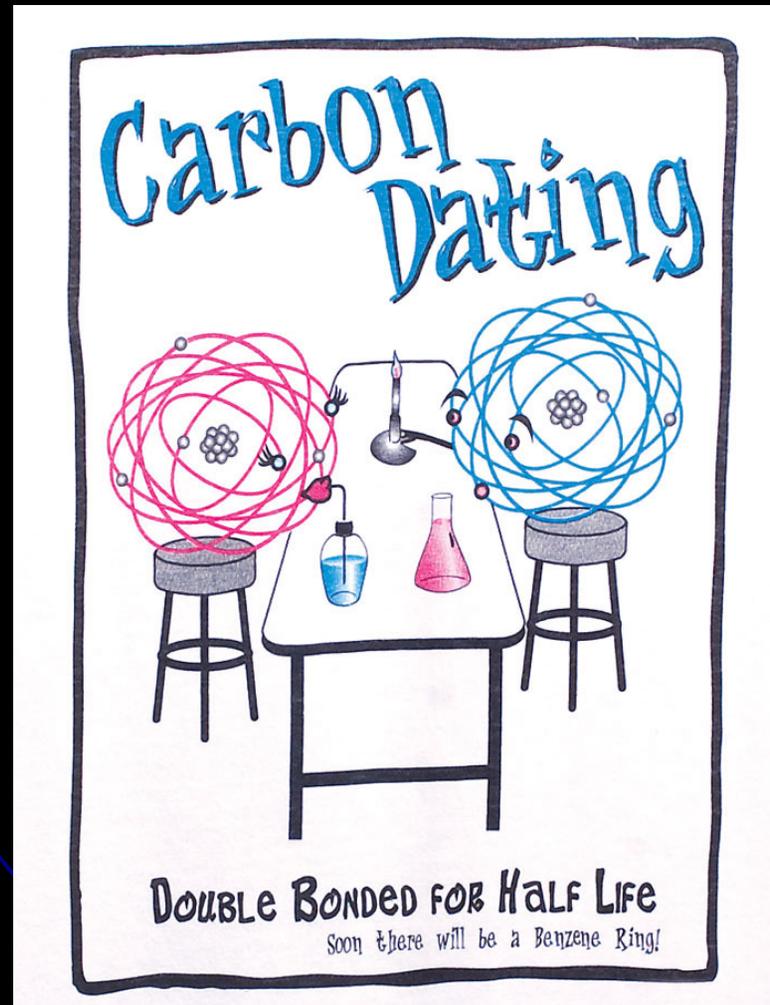
- When **nuclei** of certain isotopes are bombarded with neutrons they **undergo** fission
- **Fission** splits the nucleus into smaller fragments
- In a chain **reaction**, the neutrons released by 1 fission reaction trigger a 2<sup>nd</sup>, the 2<sup>nd</sup> triggers a 3<sup>rd</sup>, the 3<sup>rd</sup> triggers a 4<sup>th</sup> ...
- Fission is used in nuclear **reactors**



## 25.3 Fusion

- Fusion occurs when nuclei combine to **produce** a nucleus of greater mass
- Fusion **reactions** release more energy than fission reactions
- Fusion **occurs** in the sun
- In 2 stage nuclear bombs, a **fission** reaction triggers a fusion reaction
- Video: Fusion vs. Fission

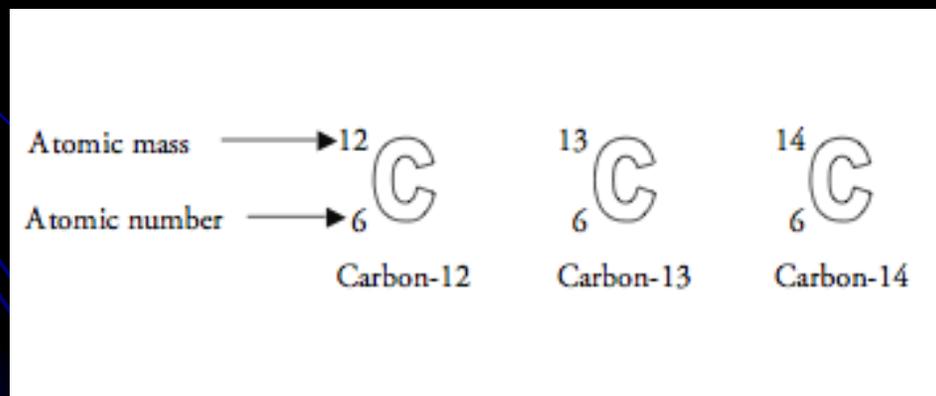
# 25.4 Carbon Dating



## 25.4 Carbon Dating

Carbon-14 dating is a way of determining the age of certain archeological artifacts of a biological origin up to about 50,000 years old.

It is used in dating things such as bone, cloth, wood and plant fibers that were created in the relatively recent past by human activities.



# 25.4 Carbon Dating

Percent $^{14}\text{C}$ Remaining	Percent $^{12}\text{C}$ Remaining	Ratio	Number of Half-Lives	Years Dead(Age of Fossil)
100	100	1 to 1T	0	0
50	100	1 to 2T	1	5,730
25	100	1 to 4T	2	11,460
12.5	100	1 to 8T	3	17,190
6.25	100	1 to 16T	4	22,920
3.125	100	1 to 32T	5	28,650