

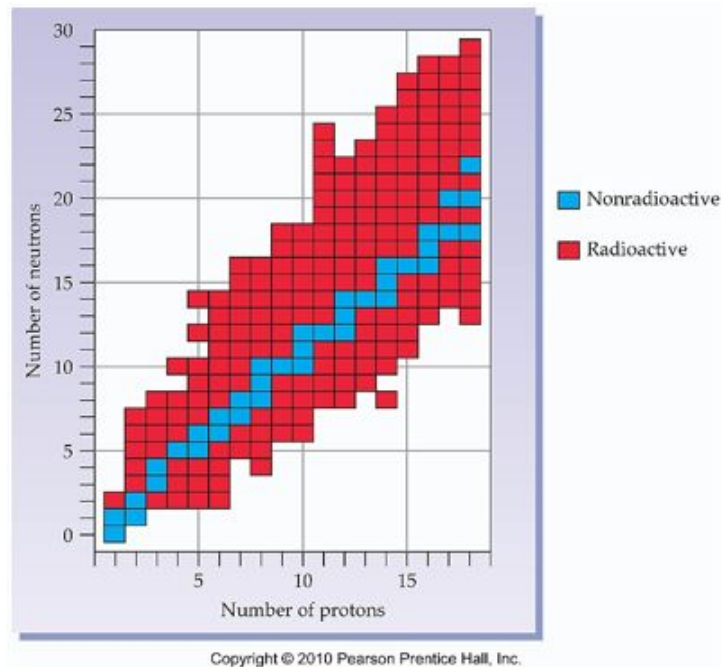
Chapter 11

Goals:

- ✓ Understand the band of stability, and know that radioactive isotopes undergo changes in the nucleus.
- ✓ Know how to write reactions for alpha, beta and gamma decay.
- ✓ Understand how radioisotopes are used in nuclear medicine for diagnostic purposes and radiation therapy.

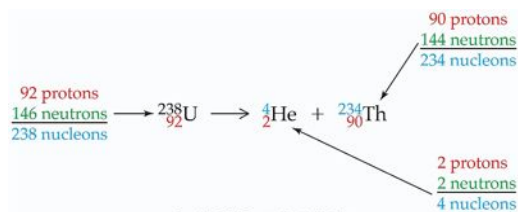
Stable Vs Unstable Isotopes

- For lighter atoms, a 1:1 ratio of neutrons to protons is stable
- For larger atoms, it takes a greater number of neutrons to maintain stability
- Beyond atomic number 83, all atoms are radioactive (unstable)
- We call atoms that are radioactive radioisotopes.

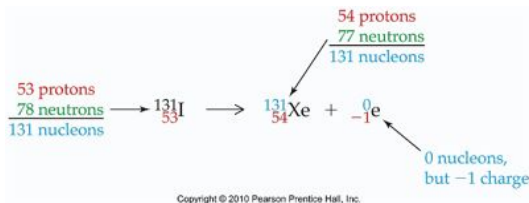


Nuclear Chemistry

- Nuclear chemistry involves a change to an atom's nucleus.
- Nuclear reactions are accompanied by tremendous energy changes as an unstable isotope spontaneously undergoes changes.
- Some types of nuclear decay include:
 1. **Alpha decay:** An atom emits an alpha particle, thus the nucleus loses 2 protons and 2 neutrons. The atomic number decreases by 2, and the mass number decreases by 4.



2. **Beta decay:** An atom emits a beta particle in the form of an electron when a neutron is changed into a proton. The atomic number increases by 1 while the mass number remains the same.



3. **Gamma decay:** Usually accompanies alpha or beta emissions as an energy release. Gamma rays cause no change in atomic or mass number since it is a form of energy only.

Nuclear Medicine

- Diagnostic Imaging: radioisotope is administered via ingestion or injection and allowed to circulate to organ/area of interest in order to assess function.
- Radiation Therapy:
 - Internal RT: radioisotope is administered via injection, ingestion or surgical implantation with the intent to release a dose of ionizing radiation high enough to kill malignant cells.
 - External RT: beam of radiation is aimed at the site of malignancy with the intent to cause death to malignant cells.



Problems from Ch 11

1. Co-60 is used in external beam radiation therapy. It undergoes beta decay which is accompanied by the emission of gamma rays. Write an equation to show this decay:
2. Po-210 has been studied for use in heating spacecraft. It undergoes alpha decay. Write a reaction to show this decay:
3. C-14 in the atmosphere undergoes beta decay. Write a reaction to show this decay: