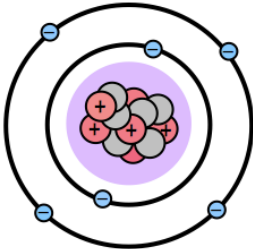
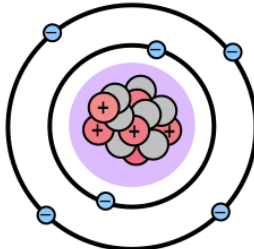
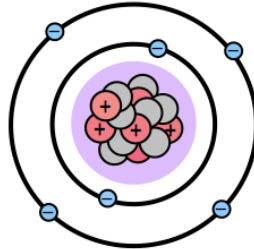


CONCEPT: ISOTOPES

- All atoms of an element have the *same* # of protons, but NOT necessarily the same number of *neutrons*.
 - _____: atoms of the same element that only vary in the number of _____.
 - _____ *atomic numbers* (# of protons) BUT _____ *mass numbers* (# of protons + neutrons).
 - Recall: *Atomic Mass* is the *average* mass of all isotopes.

EXAMPLE: Atomic Mass of Carbons 3 Isotopes.

Three Isotopes of Carbon						
99% of All Carbon Atoms	1% of All Carbon Atoms		100% of All Carbon Atoms			
	+		+		=	Atomic Mass 12.011
Carbon - $\overset{12}{\underset{6}{\text{C}}}$ 6 Protons __ Neutrons 6 Electrons		Carbon - 13 $\overset{\text{__}}{\underset{6}{\text{C}}}$ 6 Protons __ Neutrons 6 Electrons		Carbon - $\overset{14}{\underset{6}{\text{C}}}$ 6 Protons __ Neutrons 6 Electrons		

PRACTICE: What is TRUE about carbon-13 and carbon-14?

- a) They are isotopes.
- b) They have the same mass number.
- c) They have the same number of neutrons in their nuclei.
- d) They behave differently in biological reactions.
- e) None of the above are true.

PRACTICE: How are Carbon-13 and Nitrogen-15 respectively different from the more abundant isotopes Carbon-12 and Nitrogen-14? Carbon-13 and Nitrogen-15 _____:

- a) Each have an extra neutron.
- b) Each have an extra proton.
- c) Each have one less neutron.
- d) Each have one less proton.
- e) Each have one less electron.

CONCEPT: ISOTOPES

PRACTICE: The atomic number of nitrogen is 7. Nitrogen-15 has a greater mass number than nitrogen-14 because the atomic nucleus of nitrogen-15 contains _____.

- a) 7 neutrons. b) 8 neutrons. c) 8 protons. d) 15 protons.

Radioactive Isotopes

- _____ *Isotopes*: unstable isotopes that break down & emit energy in the form of rays or particles.
 - *Half-life*: time it takes for _____ of all radioactive atoms in a sample to break down.
 - Radioactive isotopes are used in *medicine & radiometric dating of fossils*.

EXAMPLE: Radioactivity of Carbon-14.

Radioactive Atom

Carbon-14 Nucleus

____ Protons

____ Neutrons

Released _____

Released _____ Particle



PRACTICE: Radioactive isotopes are utilized for all of the following *except*:

- a) Dating fossilized material of once living things.
- b) Radiation treatment to slow or stop the development of cancer cells.
- c) Labeling regions of the body with radioactivity for special imaging techniques.
- d) All of the above.

PRACTICE: The isotope Carbon-14 has a half-life of 5,730 years. How many years must pass for a sample of Carbon-14 to break down to $\frac{1}{4}$ of its original amount?

- a) 5,730 years b) 17,190 c) 11,460 d) 2,865