Atoms, Isotopes, & Ions

Parts of the Atom

	Proton (p^+)	Neutron (n^0)	Electron (e^-)
Location	Nucleus (small, massive, very high density, positive)		Outside the nucleus in orbitals (large area, very low density, negative)
Charge	Positive	Neutral	Negative
Mass	$1.673\times10^{-27}\,kg$ (1836 times greater than mass of electron)	$1.675\times10^{-27}\,kg$ (1837 times greater than mass of electron)	$9.11\times10^{-31}\,kg$
Other info	Determines the identity of the element.	Determines different isotopes of the same element	Responsible for chemical properties of the atom

Isotopes

- **Isotopes: Atoms with the same number of protons but different number of neutrons.**
- **Atomic number (*Z*) = # of protons**
- **Mass number (*A*) = # of protons + # of neutrons**
  - **# of neutrons = *A* – *Z***
- **Preview Info: In a neutral atom, number of protons = number of electrons**

Isotopes

- **Atomic symbol:** ${}^{A}_{Z}X^{\text{charge}}$ **(*X* is the symbol of the element)**
- **Hyphen name: *name* – mass#**
  symbol – mass#
- **Example:**
  - ${}^{31}_{15}P$ ***Phosphorus*–31 (*P*–31)**

Isotope Practice

	Hyphen	Atomic Number	Mass Number	p^+	n^0	e^-	symbol
protium	*H–1*	1	1	1	0	1	${}^{1}_{1}H$
deuterium	*H–2*	1	2	1	1	1	${}^{2}_{1}H$
tritium	*H–3*	1	3	1	2	1	${}^{3}_{1}H$

Isotopes

- **What is the difference between <u>mass number</u> and <u>atomic mass</u>?**
  - **Mass number: the total number of protons and neutrons of an individual isotope (Found in the CRC Handbook of Chemistry and Physics)**
  - **Atomic mass: The average mass of all stable isotopes (Found on the periodic table)**
- **Carbon-14 Dating:**
  - **When lonely carbon atoms get together at the local mall or movie theatre.**
  - **A method for determining the date of ancient wood or cloth on the basis of the radioactive decay of the nuclide carbon-14.**

6 6

Ions

- Ion: An atom that is not neutral [protons (+) ≠ electrons (-)]; it has positive or negative charge.
- Cation: A positively charged atom (a positive ion)
- Anion: A negatively charged atom (a negative ion)
- Charge = # of protons - # of electrons

IONS	Atomic Number	Mass Number	# of Protons	# of Neutrons	# of Electrons
$^{16}_{8}O^{2+}$					
$^{23}_{11}Na^{1+}$					
$^{27}_{13}Al^{3+}$					
---	---				
