

8-1

Broad Periodic Table Classifications

- Metals and nonmetals previously pointed out
- Main Group Elements (representative): filling s and p orbitals (Na, Al, Ne, O)
- Transition Elements: filling d orbitals (Fe, Co, Ni)
- Lanthanide and Actinide Series (inner transition elements): filling 4f and 5f orbitals (Eu, Am, Es)

8-2 **Electron Configuration of Transition and Inner Transition Elements**
There are Some Surprises!

- Nickel $[\text{Ar}]3d^84s^2$
- Copper $[\text{Ar}]3d^{10}4s^1$
- The further down the periodic table, the more surprises there are
- Remember chromium and copper

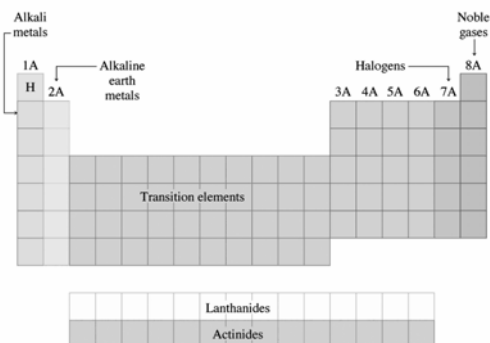
8-3

Information Contained in the Periodic Table

1. Each group member has the same valence electron configuration (these electrons primarily determine an atom's chemistry).
2. The electron configuration of any main group element.
3. Certain groups have special names.

8-4

Certain Groups Have Special Names



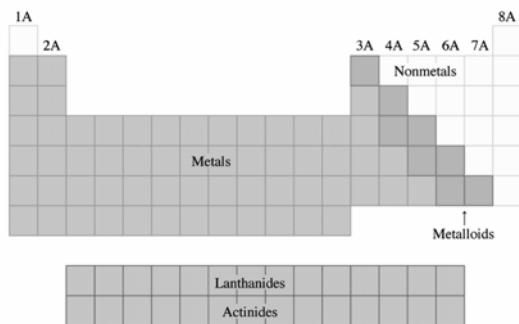
8-5

Information Contained in the Periodic Table

1. Each group member has the same valence electron configuration (these electrons primarily determine an atom's chemistry).
2. The electron configuration of any main group element.
3. Certain groups have special names (alkali metals, halogens, etc).
4. Metals and nonmetals are characterized by their chemical and physical properties.

8-6

Metals, Nonmetals and Metalloids



8-7

Properties of Metals and Nonmetals

Metal	<i>Metalloid</i>	Nonmetal
solid	<i>intermediate</i>	liquid or gas
shiny	<i>properties</i>	dull
malleable/ductile		brittle
conductive	<i>semiconductors</i>	insulators
like to give up e ⁻		like to take up e ⁻

8-8

Periodic Trends: Ionization Energy

Ionization Energy- The quantity of energy required to remove an electron from the gaseous atom† or ion‡.

†First ionization energy-

‡Second ionization energy- much bigger

8-9

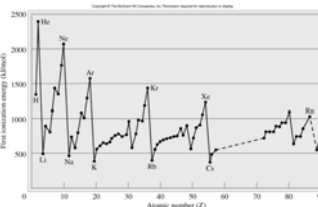
Periodic Trends: Ionization Energy

Fig. 8.11 Chang, 9th Ed.

First ionization energy- the amount of energy required to take the first electron away from an atom.

Periodic trend: increases → across a period, going ↑ a group.

He is the element with the largest ionization energy.



8-16

Periodic Trends: mp/bp

melting point- temperature at which something goes from a solid to a liquid.

boiling point- temperature at which something goes from a liquid to a gas.

Periodic trend: increases $\rightarrow \leftarrow$ across a period, going \downarrow a group.

W is the element with the highest mp, 3680 K; and bp, 5828 K.

8-17

Periodic Trends in Chemical Properties

- Reaction of alkali metals and alkaline earth metals with water
- Rate of reaction of the halogens
- Reaction with metals and oxygen: formula of the compounds
- Properties of oxides across a period: acidic, amphoteric, and basic
 - $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2 \text{NaOH}$
 - $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$
 - $\text{Al}_2\text{O}_3 + 6 \text{HCl} \rightarrow 3 \text{H}_2\text{O} + 2 \text{AlCl}_3$
 - $\text{Al}_2\text{O}_3 + 2 \text{NaOH} + 3 \text{H}_2\text{O} \rightarrow 2 \text{NaAl(OH)}_4$

8-18

STQs

- Indicate which of the following should be smaller (the size has never been determined): At or At^-
- Arrange the following by increasing first ionization energy: Na, Cl, Al, S, Cs
- Which of the following would have similar chemical properties:
 - $1s^2 2s^2 2p^6 3s^2$
 - $1s^2 2s^2 2p^3$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
 - $1s^2 2s^2 2p^6 3s^2 3p^3$
 - $1s^2 2s^2 2p^6 3s^2 3p^6$

STQs

- Explain why the first electron affinity for sulfur is 200 kJ/mol but the second is -649 kJ/mol
- Predict the products of the following oxides with water: Na_2O , BaO , CO_2 , N_2O_5 , P_4O_{10} , SO_3 . Write an equation for each and specify whether the reactions are acidic, basic, or amphoteric.
- #104, p 352
- #128, p 353
