Electrons and Chemical Bonding

Objecives

• **Describe** chemical bonding.

• **Identify** the number of valence electrons in atoms.

• **Predict** whether an atom is likely to form bonds.

I. Combining Atoms Through Chemical Bonding

A. What Is Chemical Bonding? Chemical bonding is the joining of atoms to form new substances.

B. Discussing Bonding Using Theories and Models The use of models helps people discuss the theory of how and why atoms form bonds.



II. Electron Number and Organization

A. Outer-Level Electrons and Bonding Look at the picture to see how electrons are arranged in an atom. Not all of the electrons in an atom make chemical bonds. Most atoms form bonds using only the electrons in the outermost energy level.

The first energy level is closest to the nucleus and can hold up to 2 electrons.

Electrons will begin filling the second energy level only after the first level is full. The second energy level can hold up to 8 electrons.

The third energy level in this model of a chlorine atom has only 7 electrons, so the atom has a total of 17 electrons. This outer level of the atom is not full.

II. Electron Number and Organization

B. Valence Electrons and the Periodic Table You can use a model to determine the number of valence electrons of an atom. But what would you do if you didn't have a model? You can use the periodic table to determine the number of valence electrons for atoms of some elements.

Atoms of elements in **Groups 1 and 2** have the same number of valence electrons as their group number.

H

Atoms of elements in **Groups 13–18** have 10 fewer valence electrons than their group number. However, helium atoms have only 2 valence electrons.

18

1	2		Atoms of elements in Groups 3-12 do									13	14	15	16	17	He
Li	Ве		not have a rule relating their valence electrons to their group number.									в	с	N	0	F	Ne
Na	Mg	3	4	5	6	7	8	9	10	11	12	AI	Si	Р	s	СІ	Ar
к	Ca	Sc	Ti	v	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Мо	Тс	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Та	w	Re	Os	Ir	Pt	Au	Hg	TI	Pb	Bi	Рө	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Uuu	Uub		Uuq				

III. To Bond or Not to Bond

A. Filling the Outermost Level An atom that has fewer than 8 valence electrons is much more likely to form bonds than an atom that has 8 valence electrons is.

B. Is Two Electrons a Full Set? Not all atoms need 8 valence electrons to have a filled outermost energy level. Helium atoms need only 2 valence electrons.

