CST:
hem: 1d, 1g, 2a, 1i, 2c, 7b
I:E: 1d

Noble Gas Envy

Chem Catalyst:

Q: What type of bonding does this represent?

Q: What happens to the charge on each atom?

Show transparency

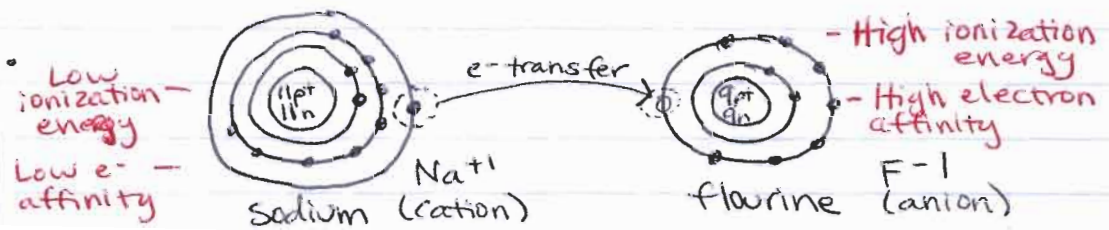
Q: what is happening in this drawing?

Q: Have any other parts of the atoms been changed?

Notes:

- What is happening in an ionic bond?
  - the metal atom transfers its valence e⁻ to the nonmetal atom ∴ becomes positively charged
  - the nonmetal atom accepts the valence e⁻ ∴ becomes negatively charged
  - the electrostatic force (attraction of (+) to (-)) holds the particles together in an ionic bond

- What is happening in NaF?



	Before	After	Before	After
# valence e:	1	8 (in lower evershell)	7	8
Charge/ Oxidation #:	neutral	+1 (more protons than e⁻)	neutral	-1 (more e⁻ than p+)
e⁻ configuration:	[Ne]3s¹	[Ne]	[He]2s²2p⁵	[Ne]

* Noble gases have full valence shells ∴ are very stable ⇒ ALL other atoms want to become like them!! (They have Noble Gas Envy)

- What is an ion?
  - an atom with a charge
  - cation: (+) charge
  - anion: (-) charge

LESSON 19 ACTIVITY

Noble Gas Envy

Ions

Name _____

Date _____ Period

Purpose

To explore the patterns in ions that form when atoms transfer electrons.

Materials

- 38 index cards

Instructions

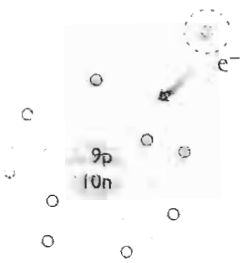
Part 1: Create Ion Cards

1. In the upper left-hand corner, number the blank cards 1 through 20, then 31 through 38.
2. Shuffle the numbered cards and divide them evenly among your group members.
3. The number on each card is the atomic number of an element. Create ion cards like the ones shown for each atomic number. Elements in Groups 1A, 2A, and 3A lose electrons. Elements in Groups 5A, 6A, and 7A gain electrons. Elements in Group 4A could gain or lose electrons, so use both sides of these cards to show either option.

11 Sodium, Na

Loses 1 e^-
Becomes Na^+

9 Fluorine, F



Gains 1 e^-
Becomes F^-

Living By Chemistry Teaching and Classroom Masters: Units 1–3

Part 2: Organize Your Ion Cards

Organize the cards according to the periodic table.

Analysis

1. List at least three patterns that you notice in the arranged cards.

   Sample Answers

   All ions in a group have the same charge.

   The elements on the left tend to form positive ions. The elements on the right tend to form negative ions.

   The magnitude of the charges increases toward the center.

2. What happens to the charge on an atom when electrons are removed?

   The atom has a positive charge. The number of protons hasn't changed, but electrons have been taken away. So protons outnumber electrons, resulting in a net positive charge.

3. What happens to the charge on an atom that gains electrons?

   The atom has a negative charge. The number of protons has not changed, but the number of electrons has increased, resulting in a net negative charge.

4. Does transferring an electron change the identity of the elements involved? Explain.

   Changing the number of electrons does not change the identity of the atom; only the charge changes. In order to change the identity of an atom, you need to change the number of protons in the nucleus.

5. **Making Sense** Why do you think this lesson is titled "Noble Gas Envy"?

   The arrangements of the electrons resemble those of the noble gas atoms. Noble gas atoms do not combine with other atoms. They are chemically stable as individual atoms. "Noble gas envy" implies that other atoms "want" to be stable like the noble gas atoms.

6. **If You Finish Early** Tin, Sn, can lose or gain four electrons.

   a. What is the charge on the tin atom if four electrons have been removed?

      +4

   b. Does tin resemble a noble gas after the four electrons have been removed? Explain.

      After four electrons are removed, an atom of tin has the same number of electrons in its outermost shell as an atom of the noble gas krypton, Kr. However, the third shell of tin has ten extra electrons compared to krypton.

Making Sense Notes:

- What are the Periodic Table trends in Ionic bonding?

* atoms tend to lose or gain e^- to attain (get) the e^- configuration of the nearest noble gas to them

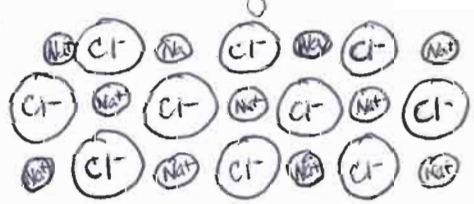
Group #	# V. e^-	lose/gain e^-?	Oxidation #/Charge?	ion?
1A (IA)	1	lose 1	+1	cation
2A (IIA)	2	lose 2	+2	cation
3A (IIIA)	3	lose 3	+3	cation
4A (IVA)	4	lose/gain 4	±4	cation/anion
5A (VA)	5	gain 3	−3	anion
6A (VIA)	6	gain 2	−2	anion
7A (VIIA)	7	gain 1	−1	anion
8A (VIIIA)	8	——	neutral	——

* Generally, METALS LOSE e^- ⇒ become (+)
  ; NONMETALS GAIN e^- ⇒ become (−)
* only the # of e^- is being changed in ionic bonding ⇒ does NOT change the atom's identity because the #protons are NOT changed

- What is a crystal lattice?

- during the formation of an ionic compound, the (+) ; (−) ions are packed into a regular repeating pattern that balances the forces of attraction ; repulsion btwn ions
  - ex: NaCl
    - Na = metal = loses 1 e^- = +1
    - Cl = nonmetal = gain 1 e^- = −1

Crystal lattice



- all (+) are surrounded by (−) ions
- all (−) ions are surrounded by (+) ions

Check In:
Q: Will K lose or gain?

[Ar]4s1 = lose 1 e^-