Good Morning

- Please take out your notebook and something to write with.
- In your notes: Write the balanced equation for Beryllium Iodide.

Homework

- Due Wednesday
- From Monday's Class: 3-7, 10, 11, 14, 16, 18, 20, 22, 41, 43, 46.
- From Tuesday's Class: 23, 25-27, 29, 48, 51

Chapter 7: Ionic and Metallic Bonding

7.1 Ions

- Valence Electrons
- The octet rule
- Formation of anions and cations

Recalling PTE Organization

- Mendeleev used similar properties of elements to organize his periodic table of elements.
- Later, scientists discovered that elements with similar properties have similar electron configurations.

Valence Electrons

- The number of electrons on the highest energy level.
- These are on the outer "shell" of the atom.
- The valence electrons are the largest contributor to chemical properties of elements.

Determining Valence Electrons

- If they are in the s or p blocks, use the number the precedes A at the top of the column (group).
- We can represent them with Lewis Dot Structures.

Groups and Valence e-: Write the charge and an example of the Lewis Structure.

- Alkali Metals:
- Alkaline Earth Metals:
- Boron Group:
- Oxygen Group:
- Halogens:

Noble Gases

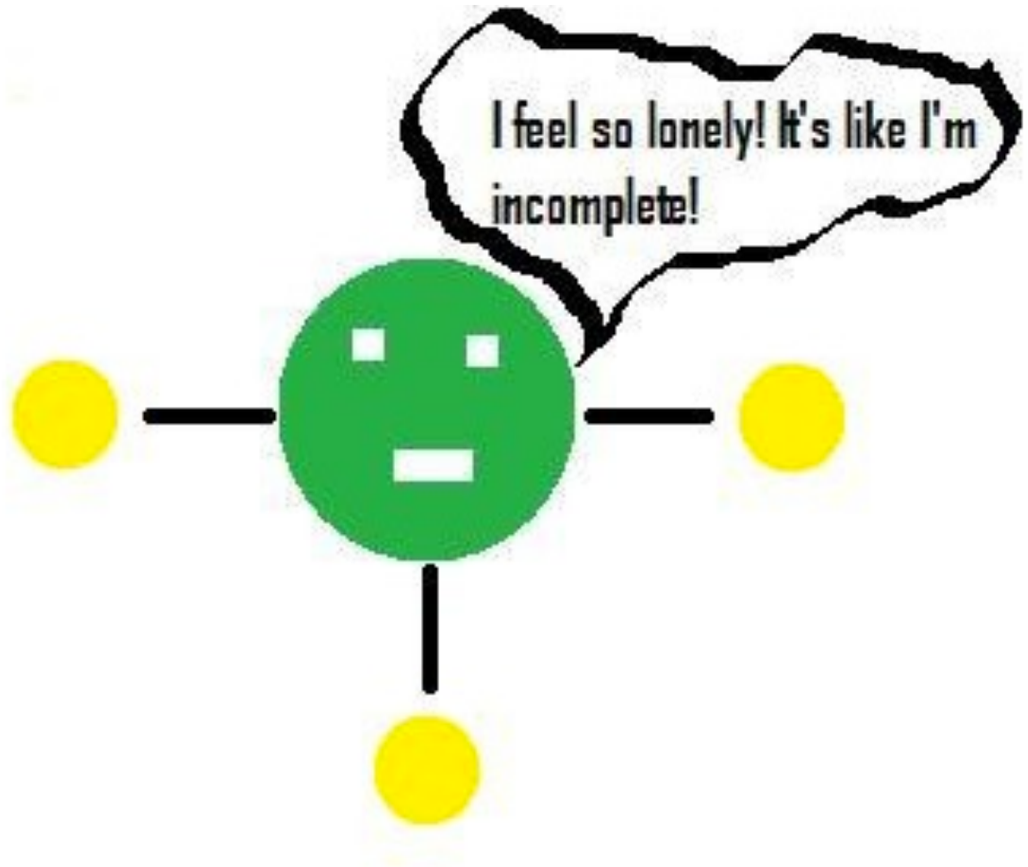
- Full Valence shell.
- Elite 8. Everyone wants to be a noble gas.
- Exception: Helium. Helium has a full shell at 2 valence electrons.

Mr. Lewis

- Gilbert Lewis (dot structure creator) was the first to say that chemicals (atoms) bond in order to get the e- configuration of a noble gas.

Octet Rule

- All atoms bond to get 8 electrons.
- This fills the valence shell.



Ions Review

- Metals generally lose electrons and become positively charged cations.
- Non-metals generally gain electrons to become negatively charges anions.

Note that Ion

- Sodium:
- Sulfur:
- Rubidium:
- Iodine:
- Aluminum:
- Lead (IV):
- Lithium:
- Tellurium:
- Calcium:
- Osmium:

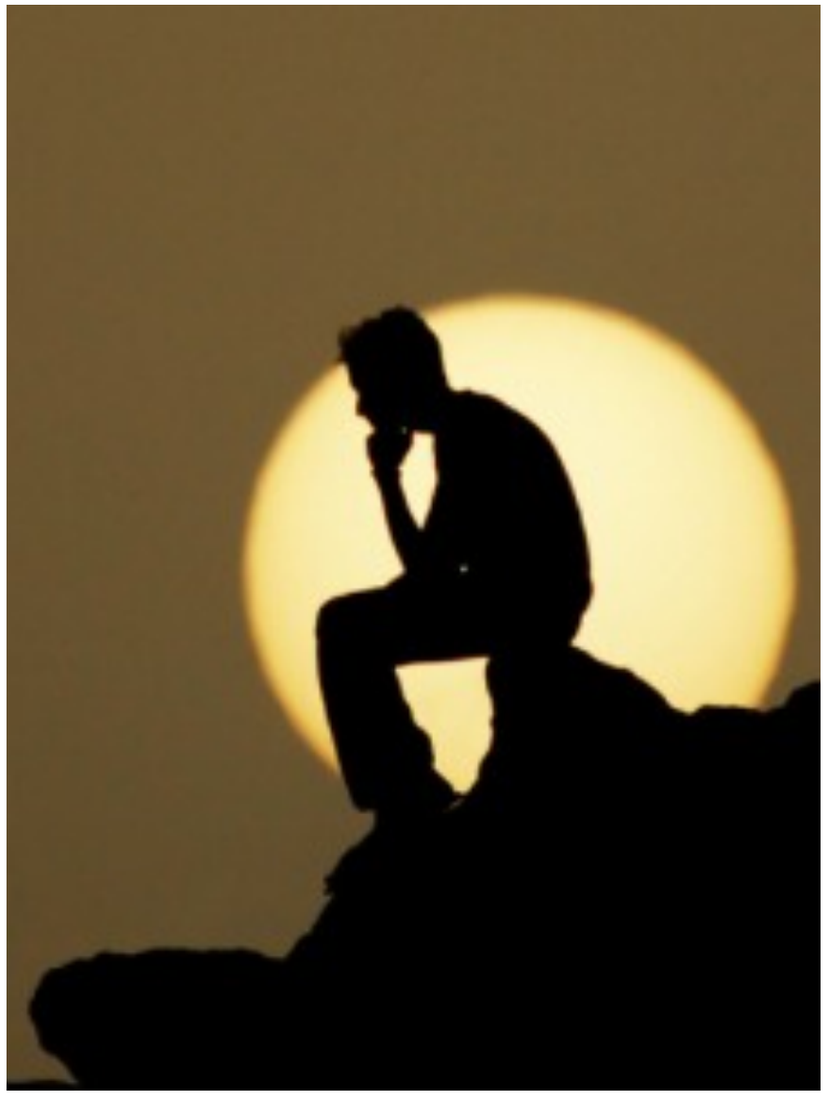
Polyatomic Ions

- These ions have net negative charges.
- They will behave similar to elements with similar charges when reacting (bonding) with other chemicals.

Thinking Deeper

- What happens when metals give their e- to non-metals?

- How do these ions behave when they have opposing charges?



7.2 Ionic Bonds and Ionic Compounds

- Charges in ionic compounds.
- Properties of ionic compounds.

Composition of Ionic Compounds

- Composed of cations and anions.
- Generally metals and non-metals.
- We can figure out the composition by balancing the charges.

Balance the Charges

- Write the balanced chemical formula.
- Sodium Chloride:
- Calcium Fluoride:
- Ammonium Nitrate:

Chemical Formulas

- Shows the kinds of elements and their number in a compound.
- Subscripts denote that the chemicals are bonded together.
- Only describe a ratio of chemicals, **not** a single unit of a compound.

Example

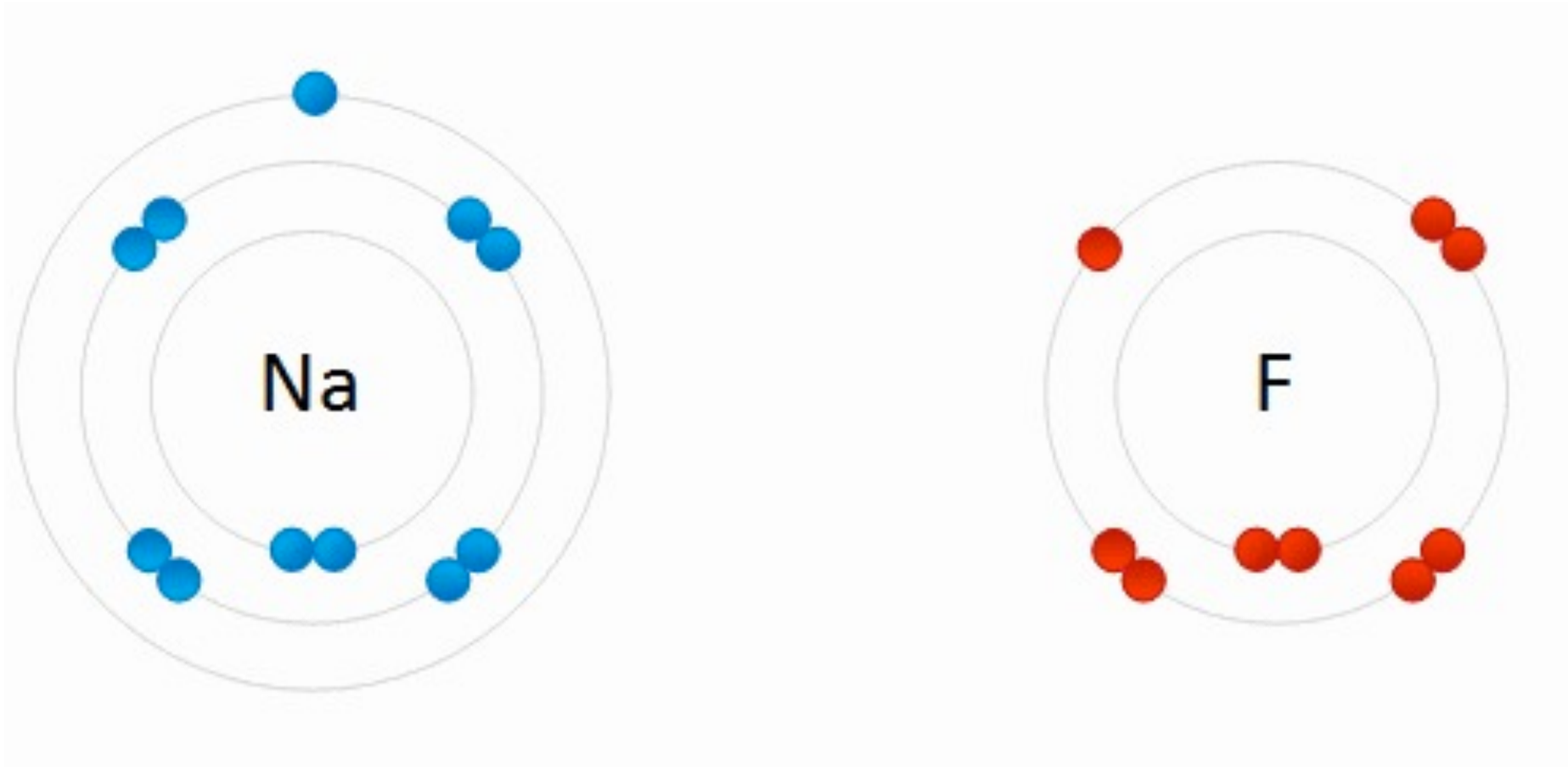
- Magnesium Bromide:
- Number of Magnesium ions:
- Number of Bromide anions:
- This is only a ratio or pattern, not the amount of Magnesium Bromide present.

Formula Units

- Smallest whole number ratio of ions in a compound.
- These are basically the chemical formula.
- The units (numbers) note the ratio of ions in the compound.

How Ions Combine

- Elements want to get to 8 valence electrons.
- Metals give their ions to non-metals.
- The elements now have opposing charges.
- Opposites attract.



Example

Properties of Ionic Compounds

- Ionic bonds are strong compared to other kinds of bonds.

- This is due to the opposing charges of the ions.

Electrostatic Forces

- Ions have an imbalance of protons and electrons.
- This leads to a net charge.
- The attraction of opposing charges leads to strong bonds.

Properties of Ionic Compounds

- Most are crystalline structure at room temp.

Crystalized Salt

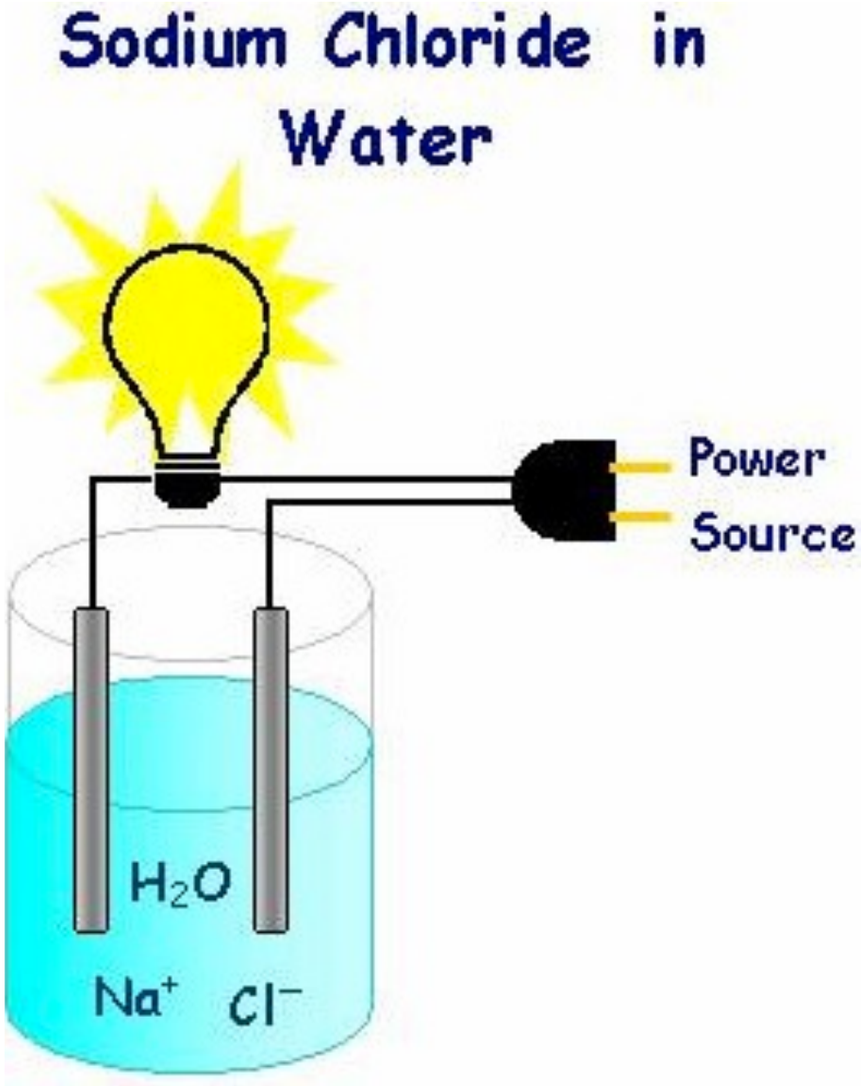
- We all need salt to live, but we take little time to think about what it really looks like.
- You may know that salt looks like a other crystals, but have not seen their exact shape.

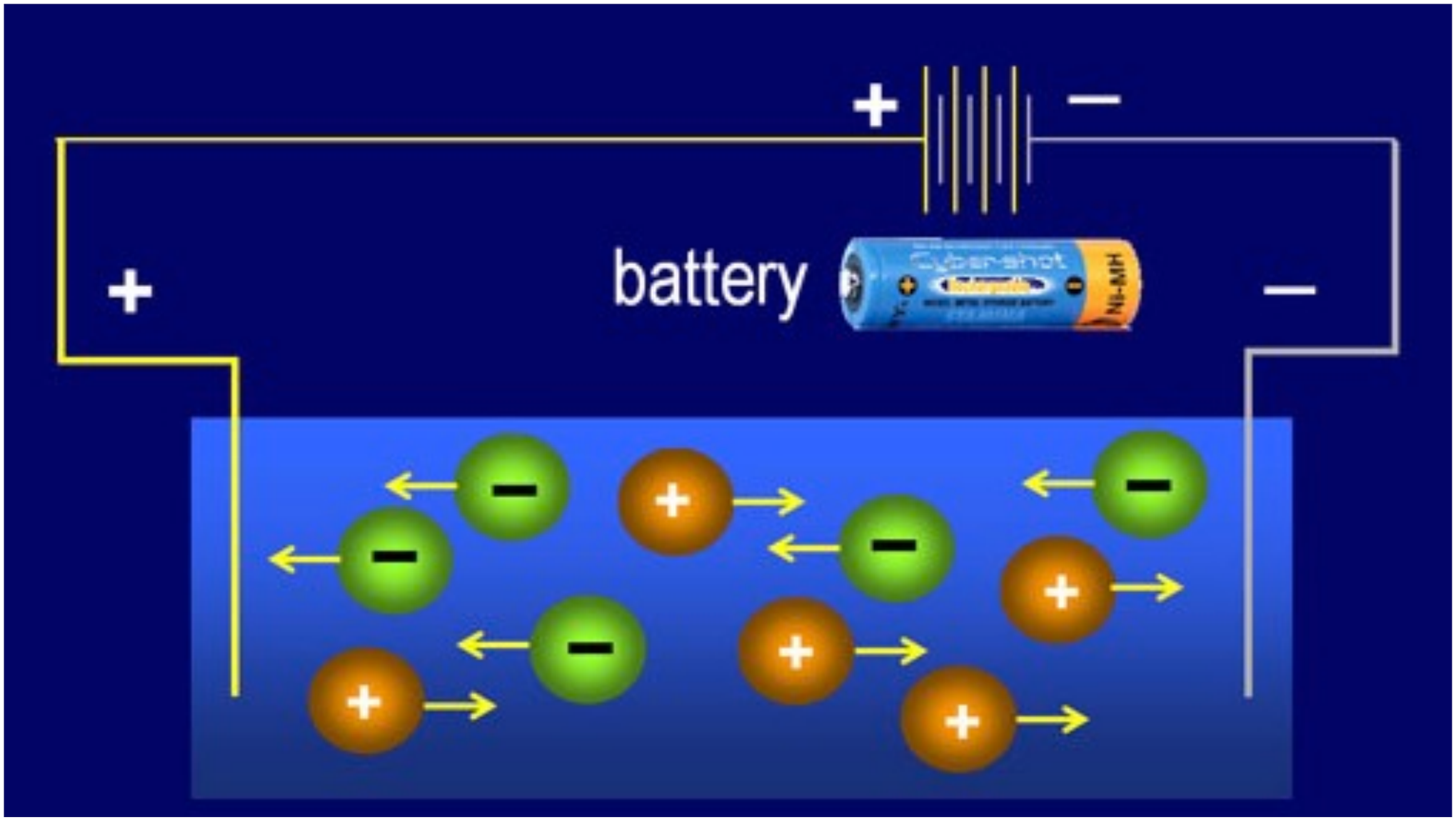
Properties of Ionic Compounds

- Generally have high boiling and melting points compared to other compounds.

Properties of Ionic Compounds

- When in **solution**, ionic compounds conduct electricity.





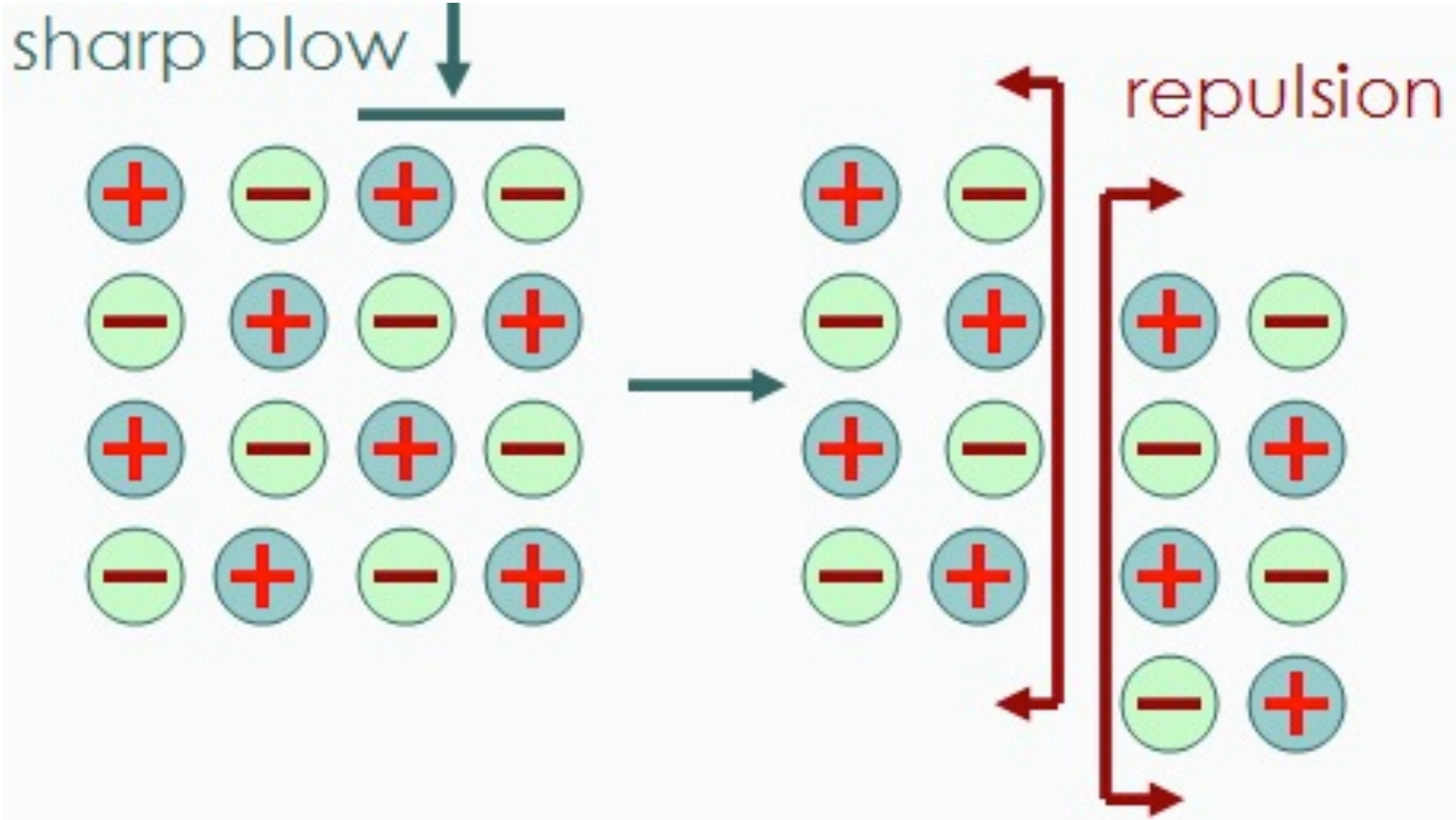
A Closer Look

Illustrations

- Draw the interaction that happens when electrodes are places in a solution containing an ionic compound.
- Present your drawing to the other group at your lab table.

Ionic compounds are brittle.

- Charges alternate in ionic crystalline structures.
- What happens when you try to move a column up or down?



Illustration

Making Salt Crystals

- Please take a handout for you and your lab partner to share.
- Begin reading over the set up and procedure.

7.3 Metallic Bonding

- Valence electrons in metal atoms.
- Arrangement of atoms in a metal.
- The importance of alloys.

What's a Metal?

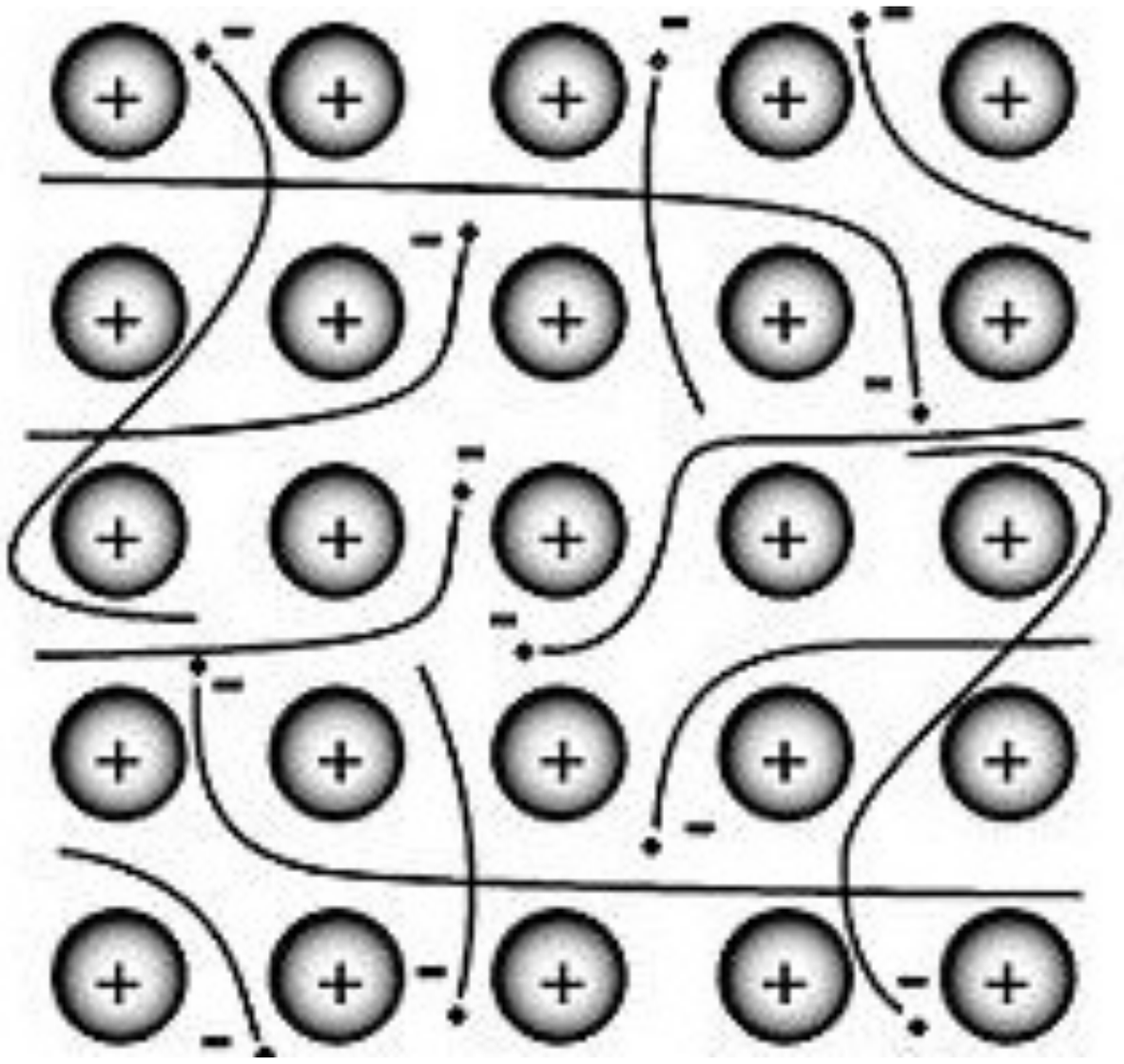
- If I asked someone on the street to name a metal, what would some of their answers be?

Valence Electrons

- What we think of as a "regular" metal is generally a transition metal.
- These metals generally have 2 valence electrons.
- What do these atoms do to become neutral?

Sea of Electrons

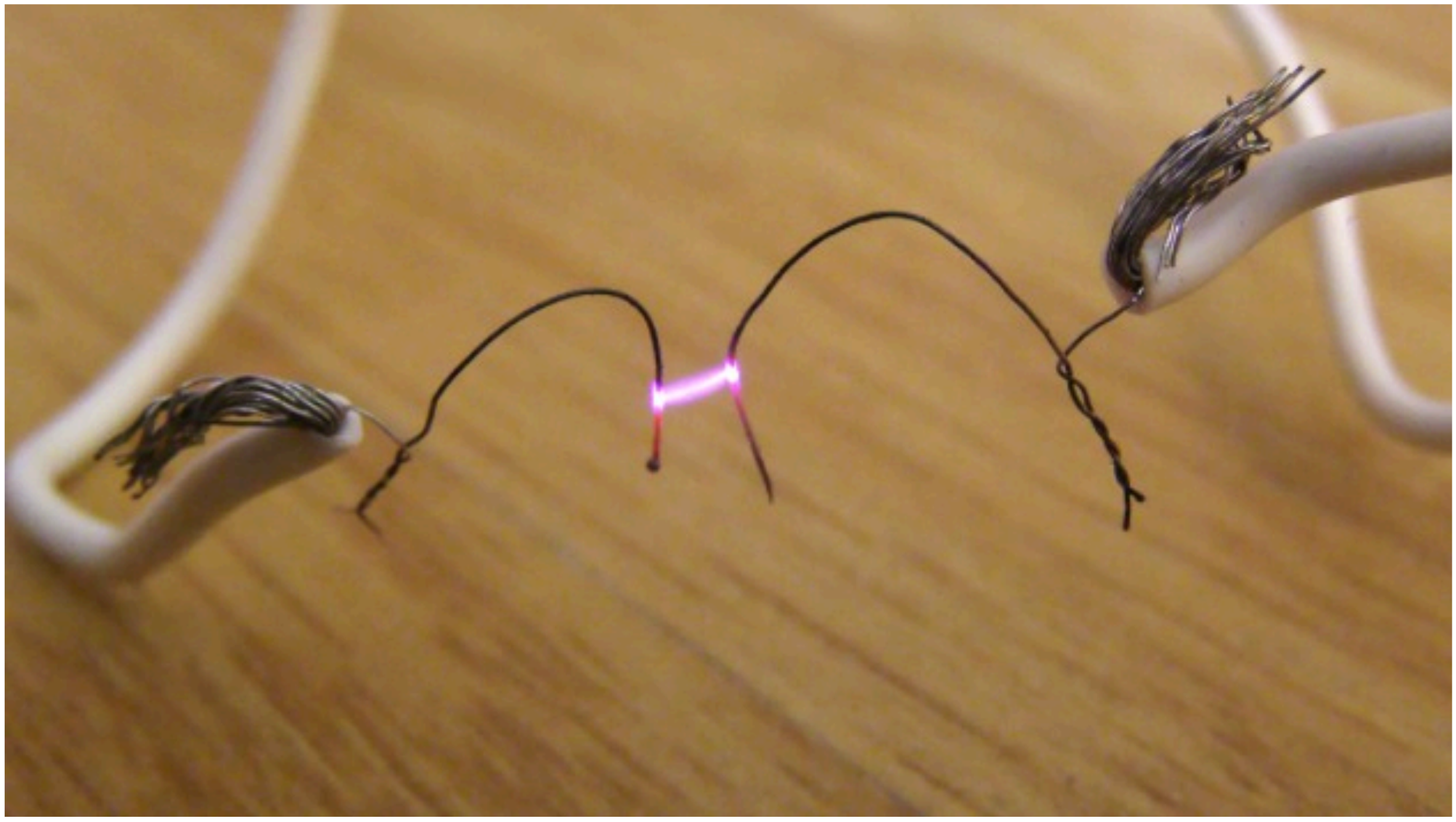
- When metals are all packed together, they all want to lose 2 electrons.
- All of these cations are packed together.
- Where do their electrons go?



Sea of Electrons

Stay Close

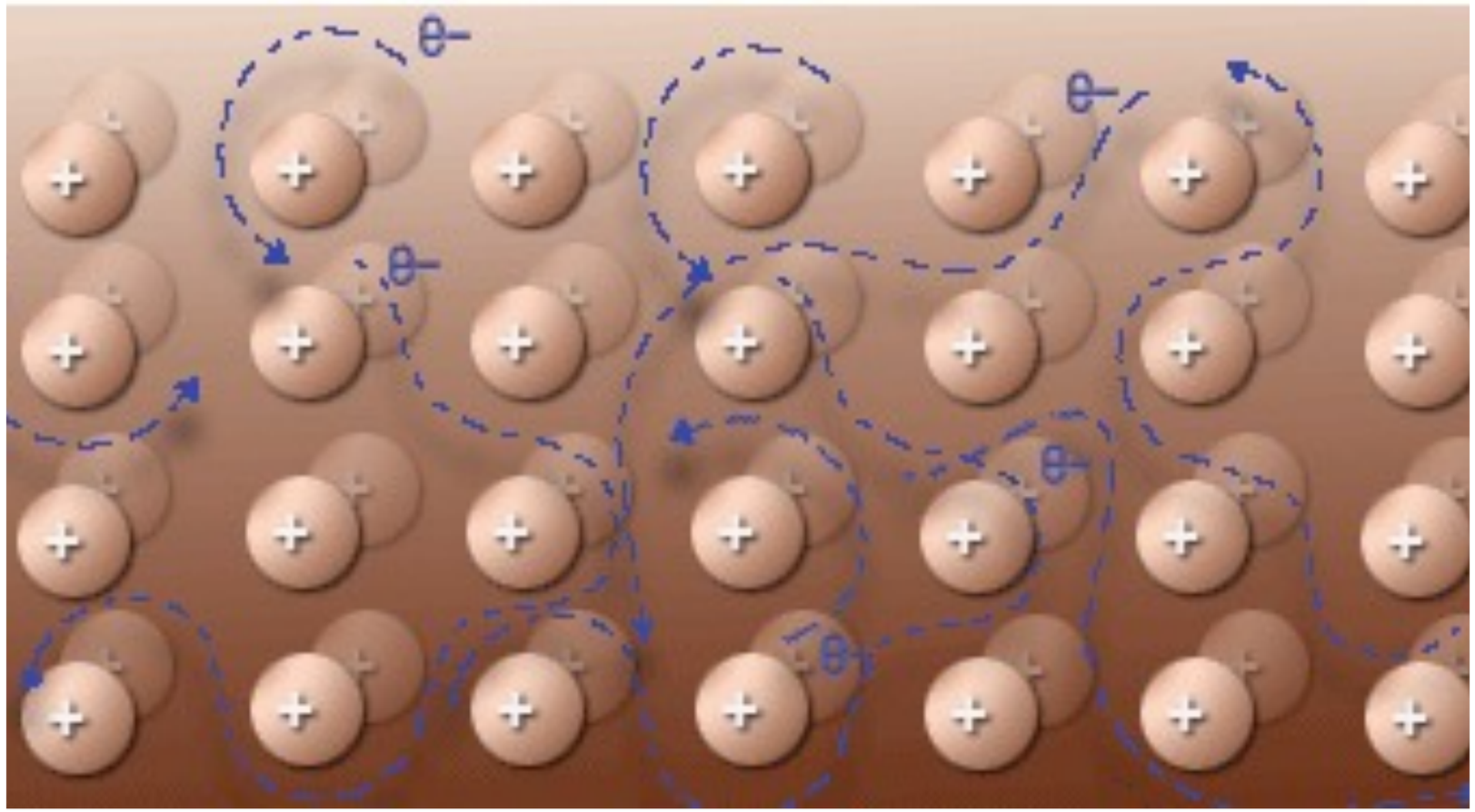
- A metal loses 2 electrons and gets a positive charge.
- It is now attracted to the electrons moving around it.
- This keeps the metals from breaking away from the sea of electrons.



Properties: Conductors

Conduction in Metals

- The free electrons in metals are repelled by electricity (negative charge).
- The electrons migrate away from the charge and bring a similar charge to the other side of the metal.



Illustration

You Present

- Draw a representation of a metallic bond.
- Present your picture to the other group at your lab table.
- Explain why metals make good conductors.

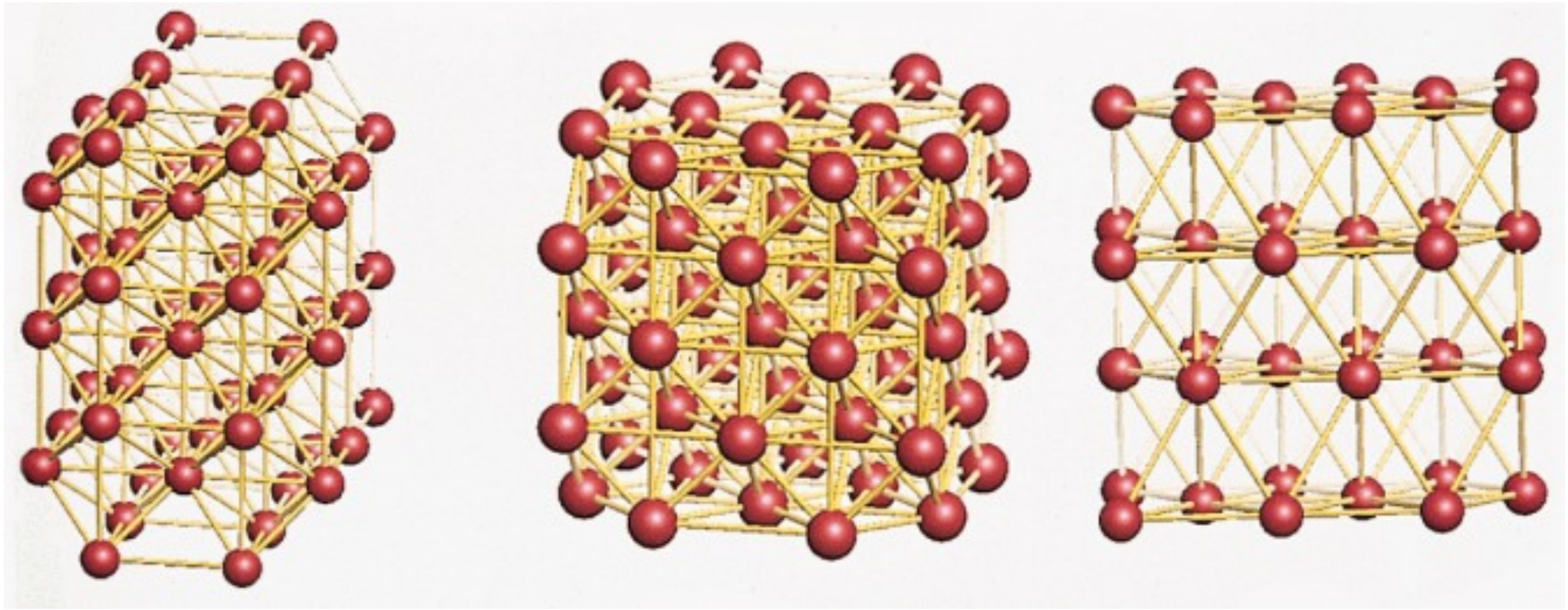
Ductile

- Metals can be molded into wires.
- This is because the cations can remain stable when we move them through the “sea of electrons.”
- Why wouldn’t this work in ionic compounds?

Structure

- Metals are tightly packed.
- The optimize space and form crystal-like structures.

Silver



Metallic Crystal Structures

Alloys

- A mixture of 2 or more elements.
- Very few of the metals that we use are pure metals.
- Because pure metals are ductile, they may be weaker.
- Adding other elements polarizes crystalline structures.

Examples

- Sterling Silver: 92.5% Silver, 7.5% Copper.
- Cast Iron: 96% Iron, 4% Carbon.
- Stainless Steel: 80.6% Fe, 18.0% Cr, 0.4% C, 1.0% Ni.