PART I: WHAT ARE IONIC COMPOUNDS?

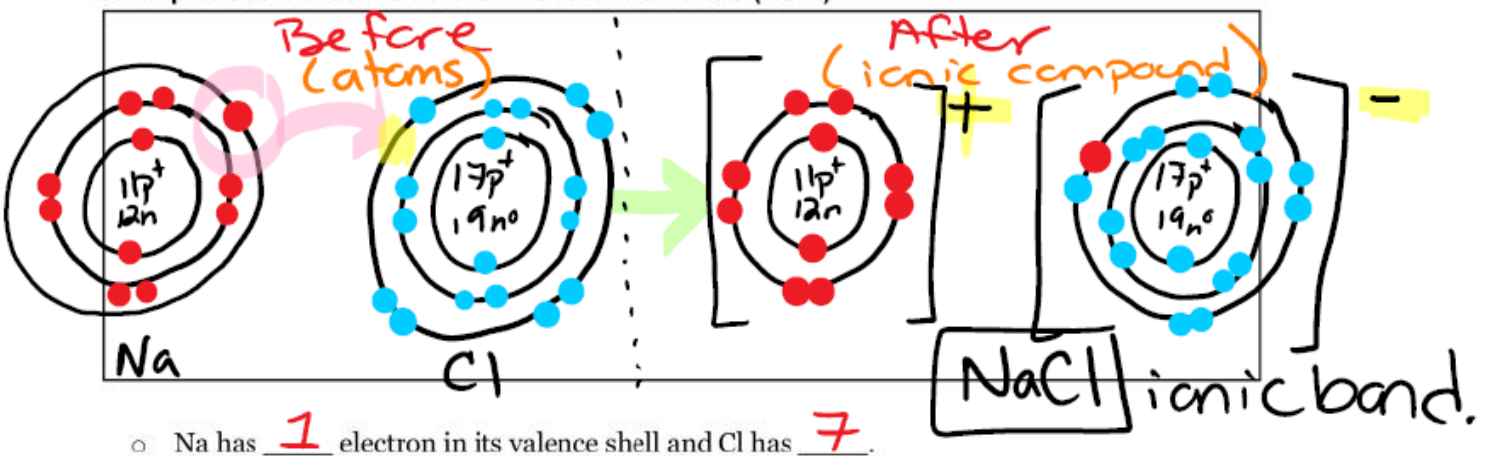
Atoms want to gain or lose electrons to have a full outer shell (full valence shell). A full outer shell is a stable electron arrangement. When this happens atoms become charged ions ⊕/⊖

When a cation ⊕ gives its electron/s to a anion ⊖ they join to form an ionic compound.

The ion charge is the number of electrons an atom must gain or lose to have a stable electron arrangement (full valence shell).

ALL atoms want a full shell!

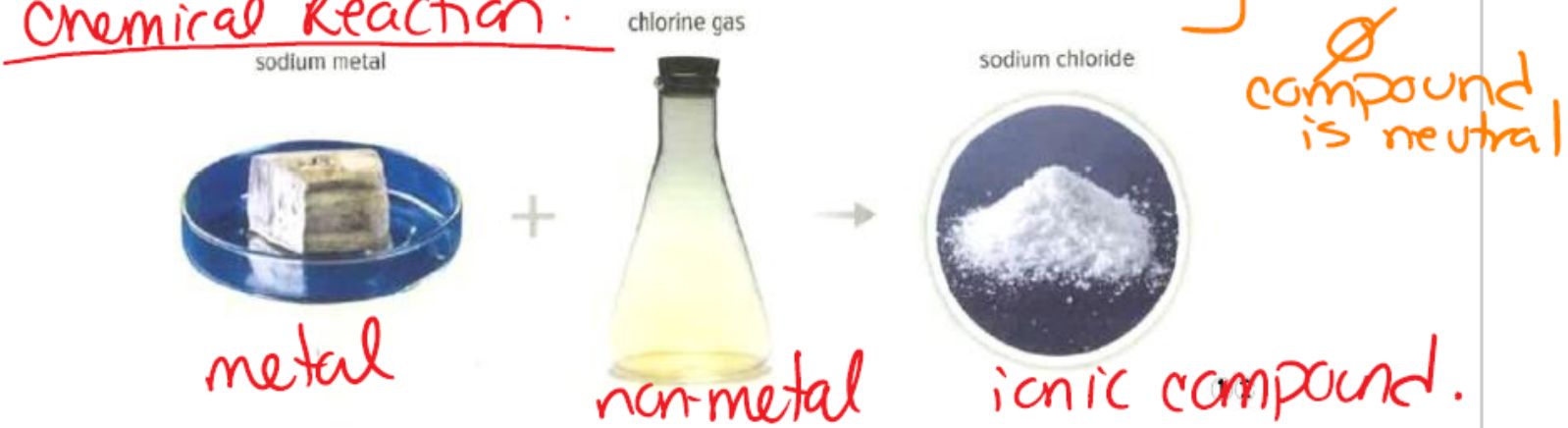
Example: sodium and chlorine → sodium chloride (NaCl)



- Na has 1 electron in its valence shell and Cl has 7.
- Sodium needs to lose 1 electron and chlorine needs to gain 1 electron.
- The electron is transferred, and two ions form both having Full outer orbitals.
- The ions are charged: Na has a +1 charge, and Cl has a -1 charge.

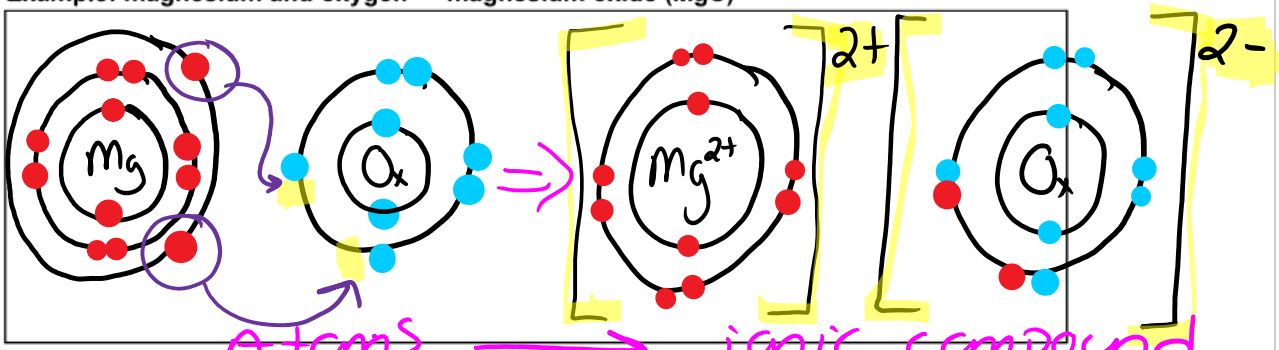
] +1 -1 = 0 compound is neutral

Chemical Reaction:



- Atoms with positive (+) ion charges (they lose electrons) are the metals. They form positive cations
- Atoms with negative ion charges (they gained electrons) are the non-metals. They form negative anions
- Sometimes atoms need to lose or gain ***more than one*** electron.
  - For example, magnesium needs to lose 2 electrons and oxygen needs to gain 2 electrons. The solution is to use one of each atom but to transfer 2 electrons!

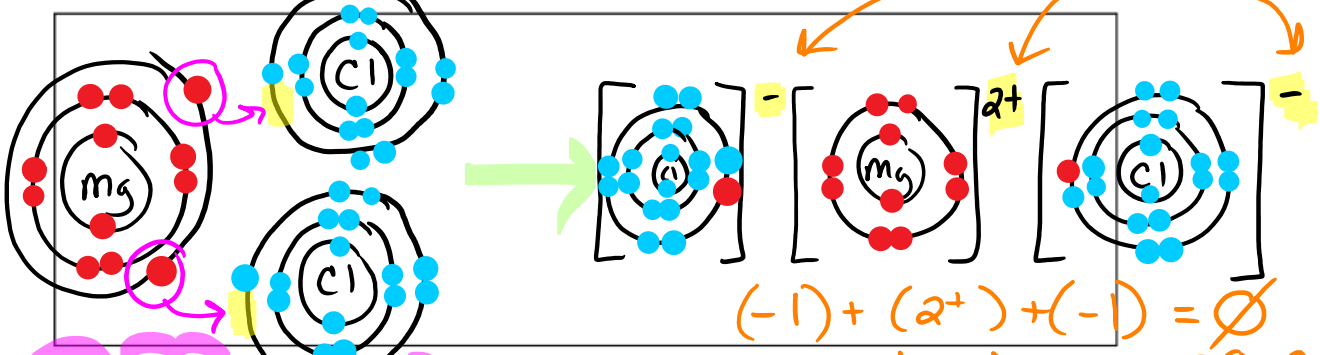
Example: magnesium and oxygen → magnesium oxide (MgO)



- But what happens when the electron requirements are different? For example, magnesium needs to lose 2 electrons whereas chlorine only needs to gain 1 electron. The solution is to use 2 chlorine atoms for every 1 magnesium atom.

Example: magnesium and chlorine → magnesium chloride ($MgCl_2$)

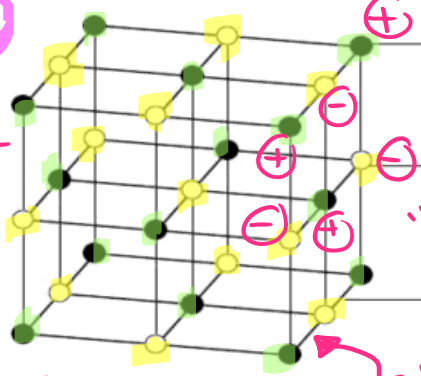
write the charges



(-1) + (2+) + (-1) = Ø

ionic compound.

Structure of Ionic Compounds



Sodium chloride

NaCl

1 -> Na

1 -> Cl

1:1 ratio of ions

"crystalline lattice" (regular pattern)

strong bonds hold together

PRACTICE Study the images below and answer the question at the end of the caption.

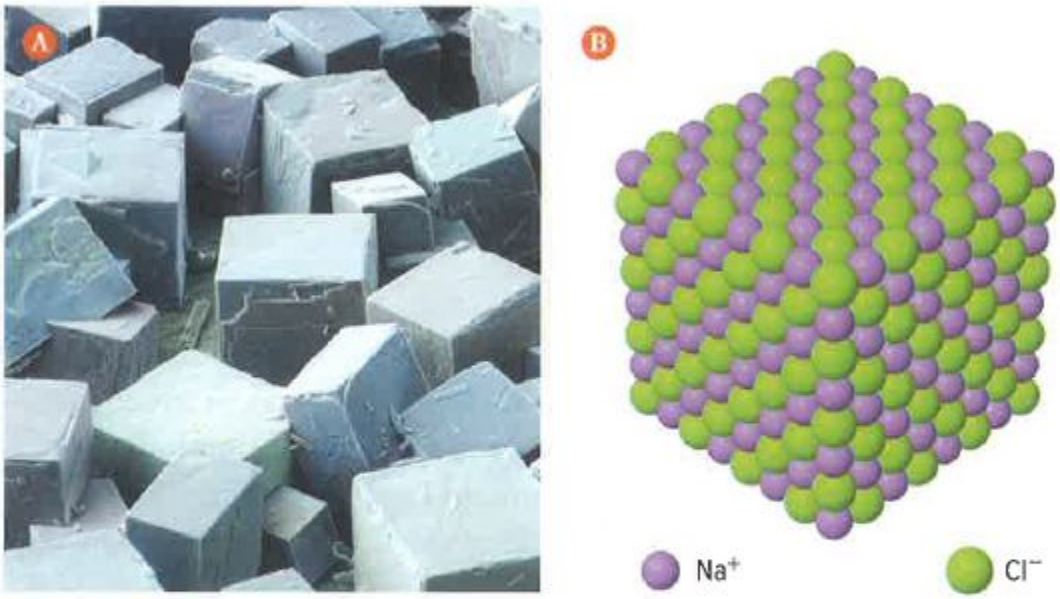


Figure 2.24 A This image shows the cubic structure of sodium chloride crystals. Each crystal contains millions and millions of sodium ions and chloride ions. B Sodium chloride crystals consist of sodium and chloride ions arranged in a repeating pattern. **Sodium chloride is made of charged particles, but the compound overall has no charge. Why?**

$(+1) + (-1) = \emptyset$

The charges ⊕positive and ⊖negative all balance out in ionic compounds so that the overall compound is neutral (∅).

PART J: PROPERTIES OF IONIC COMPOUNDS

b/c of strong bonds.

1. **Ionic compounds have** high melting points

Melting an ionic compound requires overcoming strong electrostatic (attract) forces that hold the ions together.

Because these bonds are strong, a great deal of energy is required to break them. As a result, ionic compounds tend to melt only at very HIGH temperatures.

For example the melting point of sodium chloride (NaCl) is 801 °C (exact)

2. **Ionic compounds are** Hard + brittle solids.

Because of the strength of ionic bonds, ionic solids are very hard. But when enough force is applied the ions will shift out of alignment. This causes ions with the same charge to be close together. These ions will then Repel (Like charges repel)

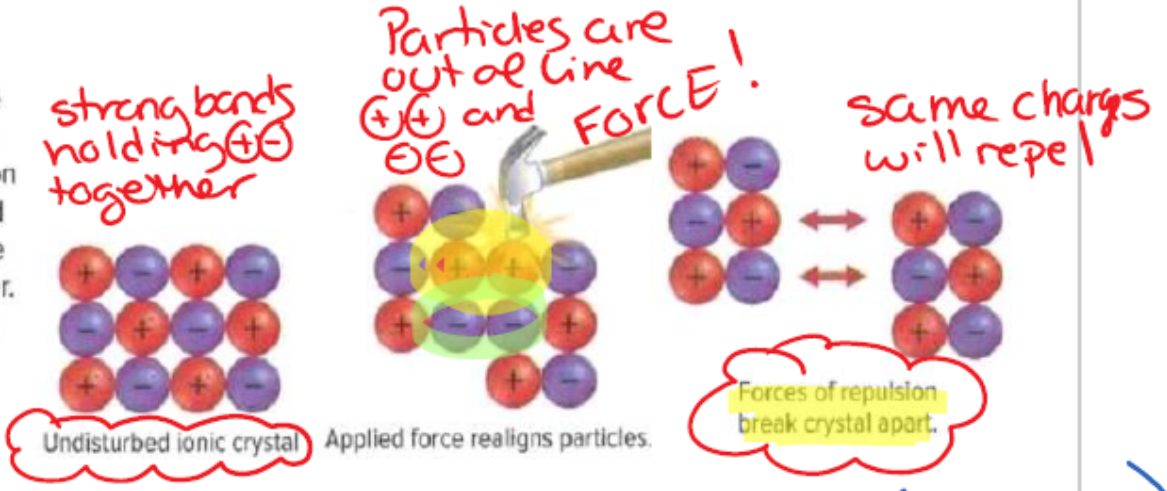
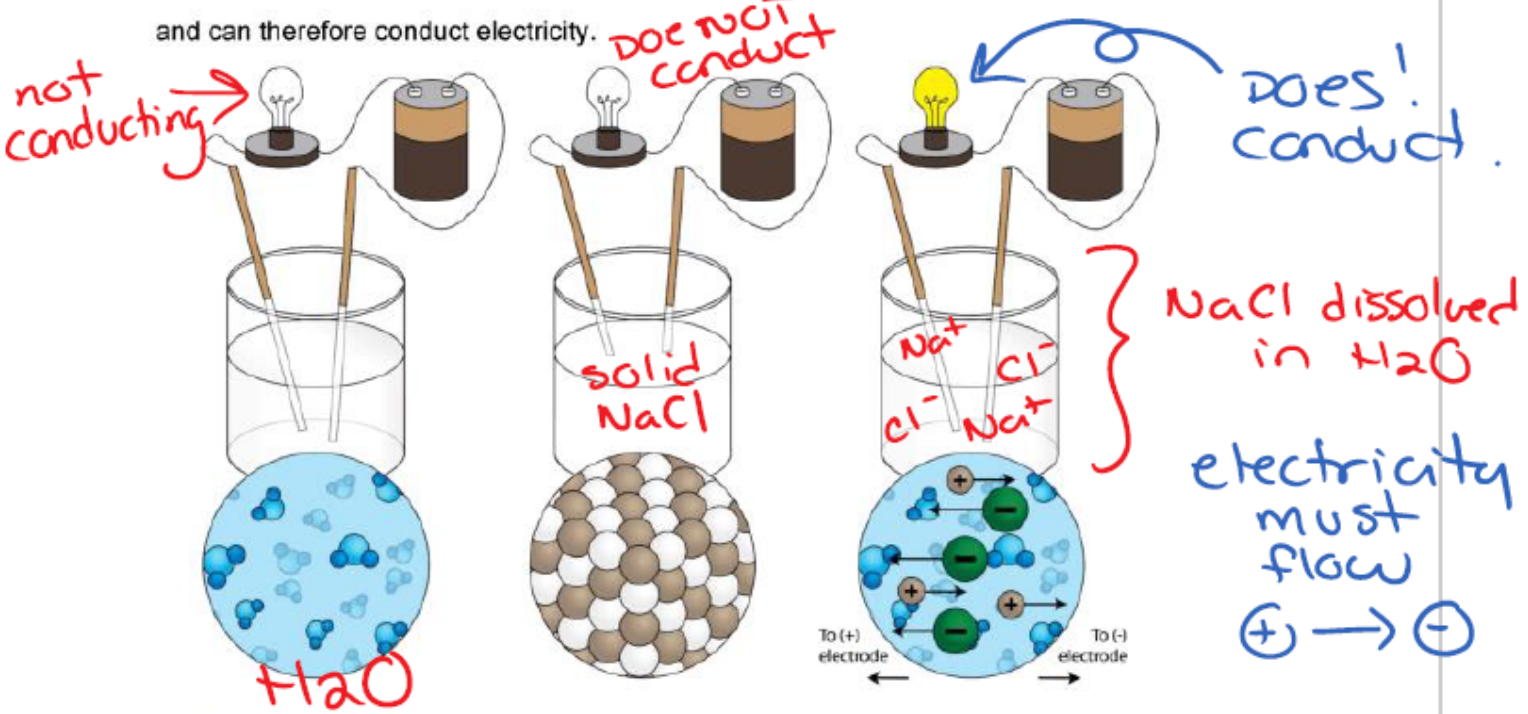


Figure 2.25 When a force strong enough to overcome the strong forces of attraction between oppositely charged ions is applied, ions with like charges come close together. They repel one another and the solid cracks.

3. **Ionic compounds conduct** electrical current (only when dissolved in solution)

In these states, the ions that make up an ionic compound are free to move around and carry an electric charge. and can therefore conduct electricity.



ASSIGNMENT #6: Ionic Compounds Summary pg 30

This assignment is to be completed below in the space provided.

Summary:

1. **How do you know if something is an ionic compound?**

An ionic compound will contain a + charged metal (cation) and a - charged non-metal (anion)

2. **What is happening with the electrons in the formation of an ionic compound?**

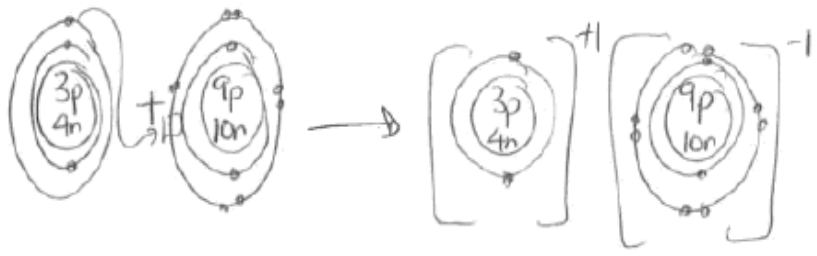
The metal (+) cation will transfer the electron that it is "losing" to the non-metal (-) anion. That is how the cation becomes (+) and the anion becomes (-)

3. **What are some general properties of ionic compounds?**

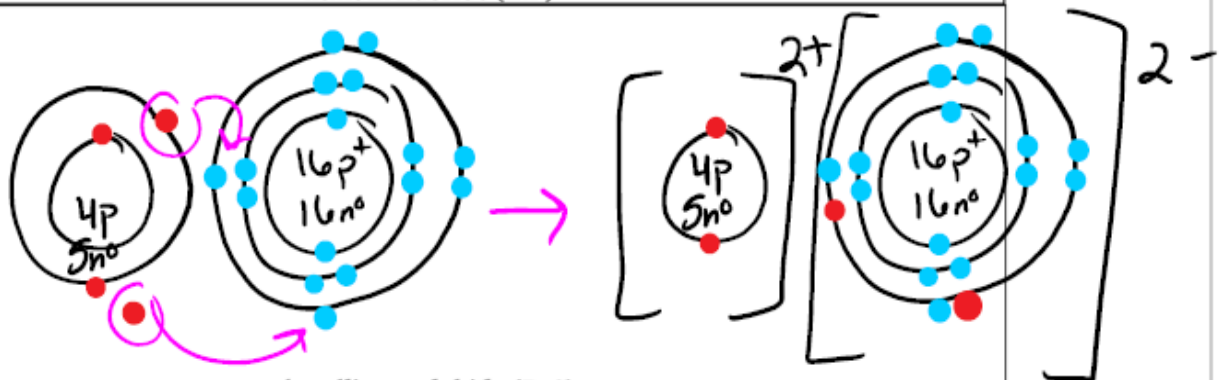
Properties of Ionic Compounds

- metals + non-metal
- ⊕ cations + ⊖ anions
- strong bonds:
  - solid at room temp
  - melting points are very high (°C)
- dissolve in water to form ions ⊕ and ⊖ in solution
- conduct electricity (in liquid or molten state)

Draw the Bohr diagrams of the following ionic compounds below. Start with the at then draw the ions.



lithium fluoride (LiF)



beryllium sulphide (BeS)