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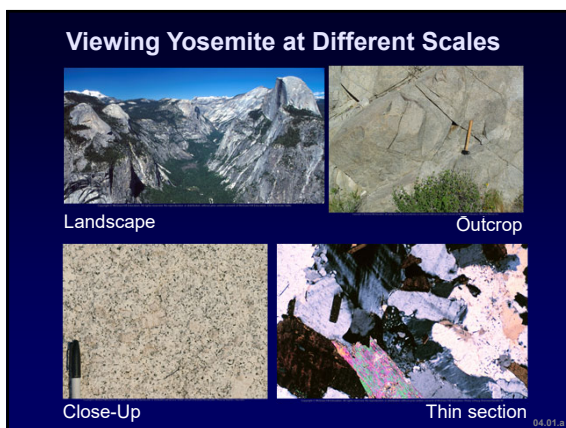
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Observe the differences between these two rocks



Composed of visible or microscopic crystals:  
crystalline rock



Composed of pieces (clasts):  
clastic rock

04.02.a

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Observe that these rocks have more than one type of mineral



Crystalline



Clastic

04.02.b

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Observe that these rocks have large crystals or clasts (photos show the same size of polished slab)



Crystalline



Clastic

04.02.b

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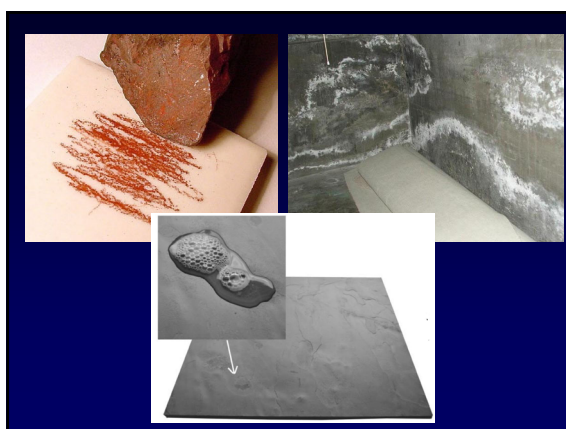
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No.	Mineral	Color	Luster	Streak	Hardness
1	Talc	White, green, gray	Pearly, greasy	White	1
2	Gypsum	White, gray	Silky	White	2
3	Calcite	White, yellow, brown, blue	Vitreous, earthy	White	3
4	Fluorite	Green, yellow, purple	Vitreous	White	4
5	Apatite	Green, colorless, yellow, blue, violet, pink, brown	Vitreous, subresinous	White	5
6	Feldspar	Pink, white, gray, brown	Vitreous	None	6
7	Quartz	Colorless, white	Vitreous	None	7
8	Topaz	Blue, brown, orange, gray, yellow, green, pink and reddish pink	Vitreous	White	8
9	Corundum	Colorless, gray, brown, pink, pigeon-blood-red, orange, yellow, green, blue, cornflower blue, violet	Adamantine, vitreous	None	9

**Hardness**

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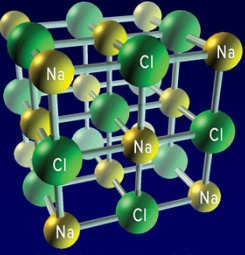
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### What Controls a Crystal's Shape?

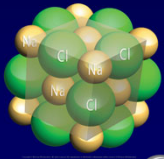
**Halite (NaCl)**



**Internal structure of halite**



**Sizes and packing of atoms**



04.04.a

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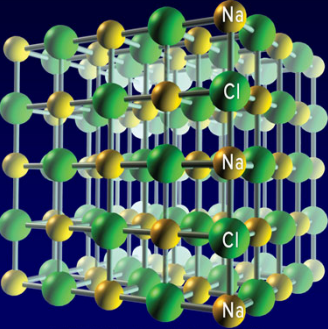
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### Crystalline Structure



Orderly arrangement of atoms in repeating pattern

04.04.a3

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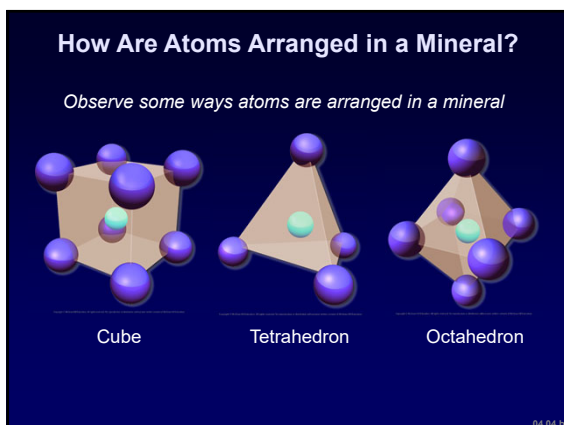
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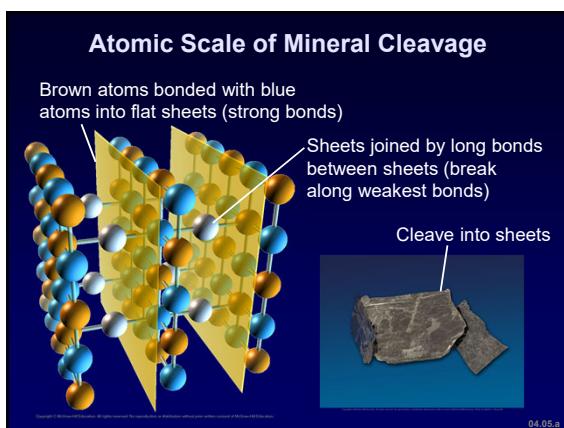
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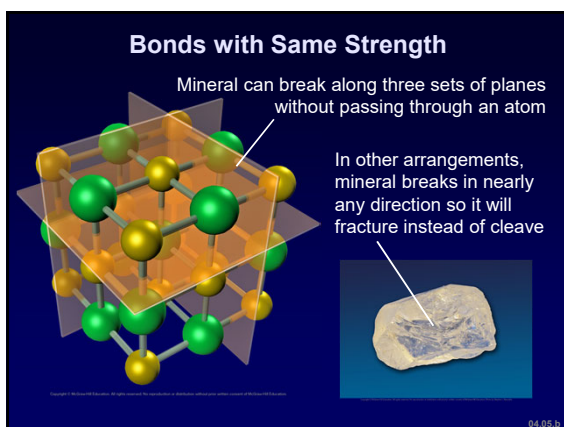
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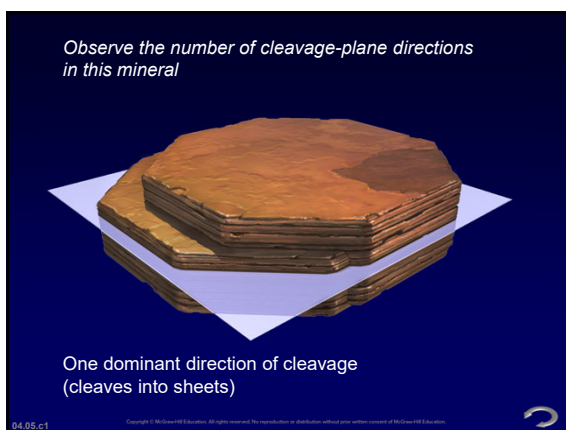
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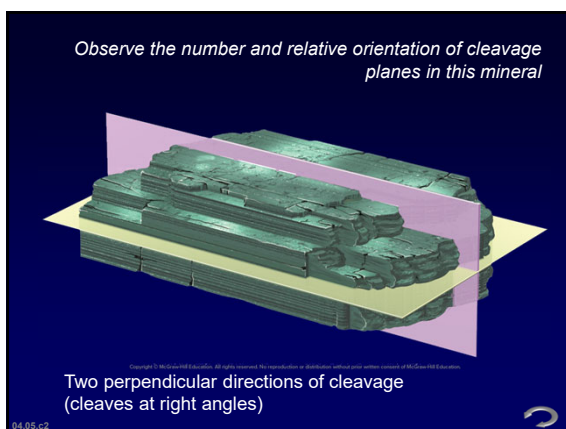
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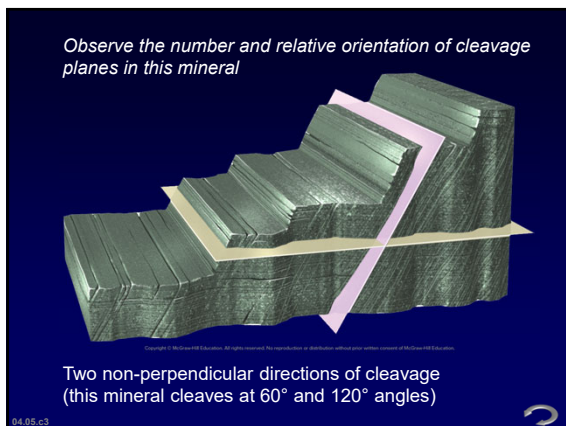
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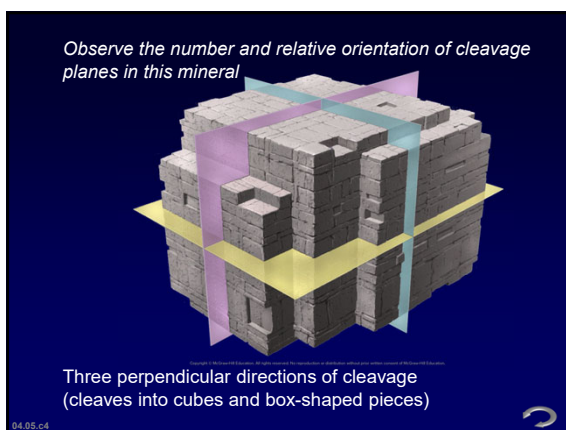
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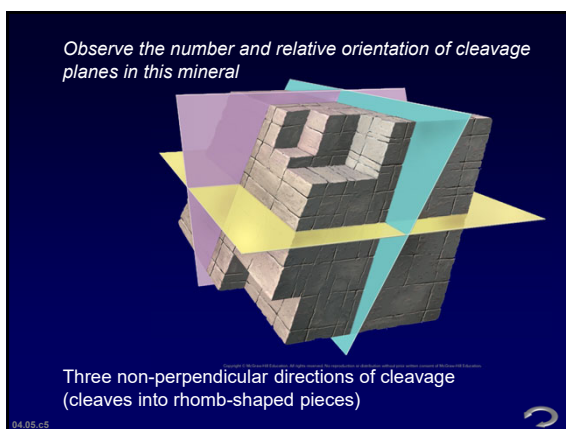
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### Cleavage

Cleavage is the tendency of a mineral to break along smooth planes parallel to zones of weak bonding

Cleavage in one direction. Example: MUSCOVITE

Cleavage in two directions. Example: FELDSPAR

Cleavage in three directions. Example: HALITE

Cleavage in two directions. Example: CALCITE

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### Periodic Table

Letters are abbreviation for element

Number is atomic number (number of protons)

Color represents type of element

- Main Group Metals
- Transition Metals
- Nonmetals
- Noble Gases
- Lanthanide Series
- Actinide Series

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### Major Classes of Rock-Forming Minerals

Carbonates, Oxides, Halides, Silicates, Sulfides, Sulfates, Native minerals

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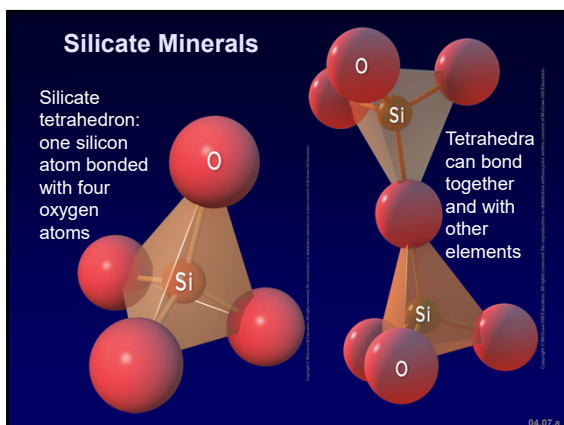
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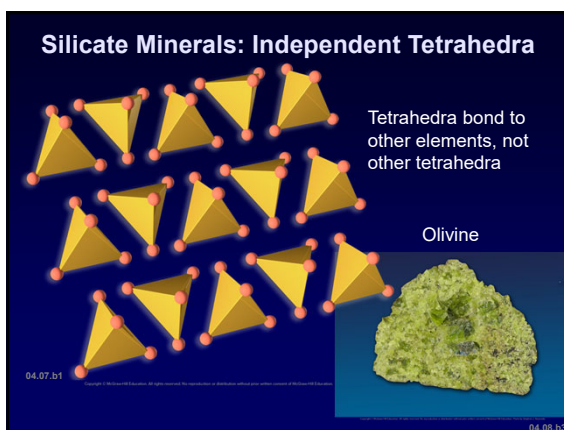
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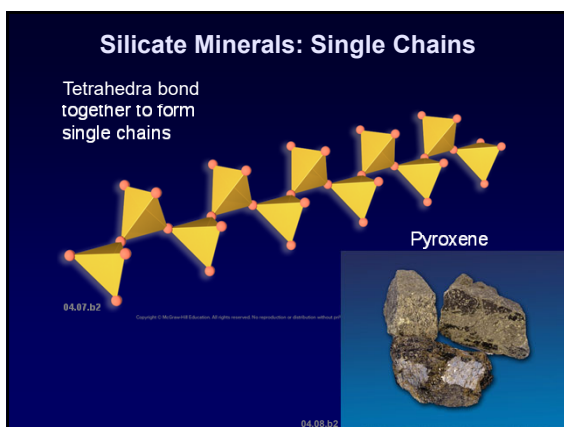
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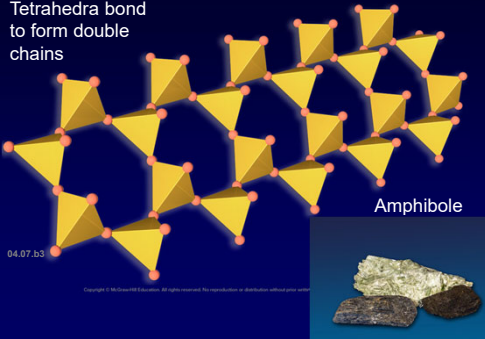
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### Silicate Minerals: Double Chains

Tetrahedra bond to form double chains



Amphibole

04.07.b3

04.08.b1

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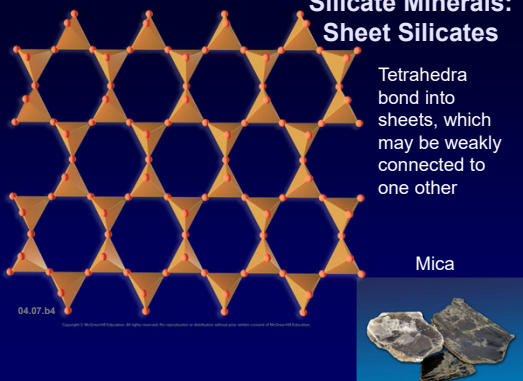
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### Silicate Minerals: Sheet Silicates

Tetrahedra bond into sheets, which may be weakly connected to one other



Mica

04.07.b4

04.08.b4

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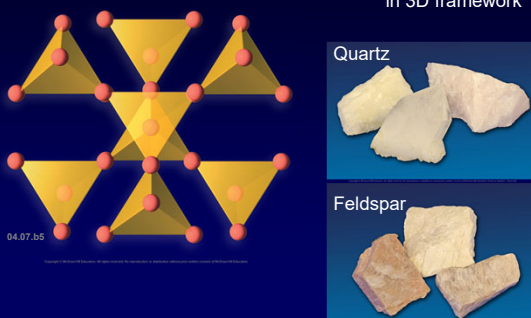
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### Silicate Minerals: Frameworks

Tetrahedra bonded together and with other elements in 3D framework



Quartz

Feldspar

04.07.b5

04.08.a1.3

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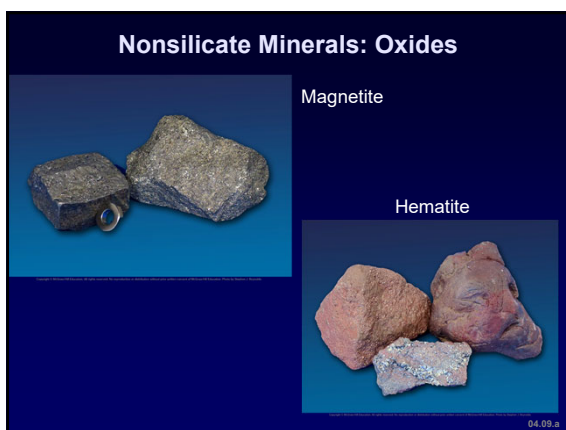
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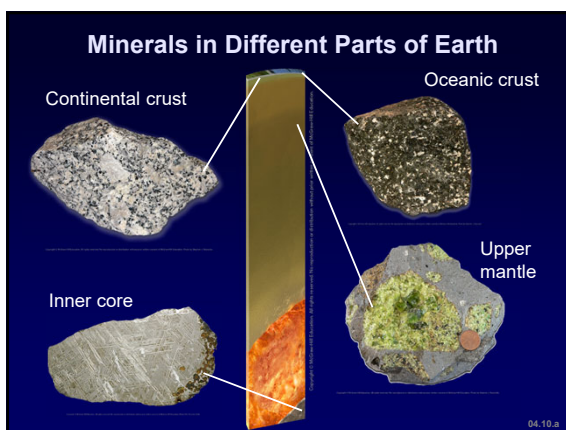
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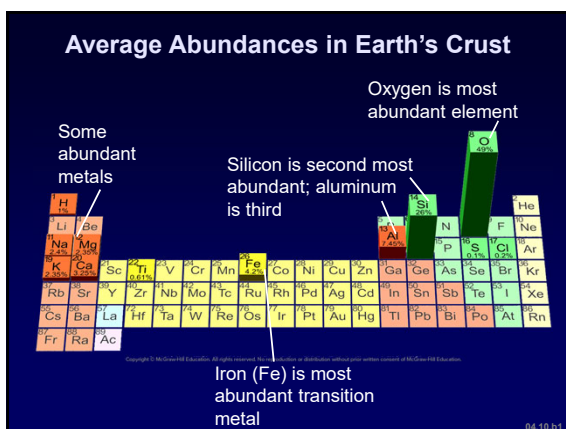
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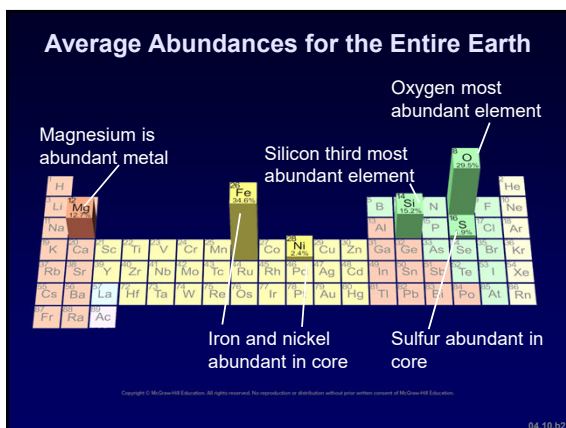
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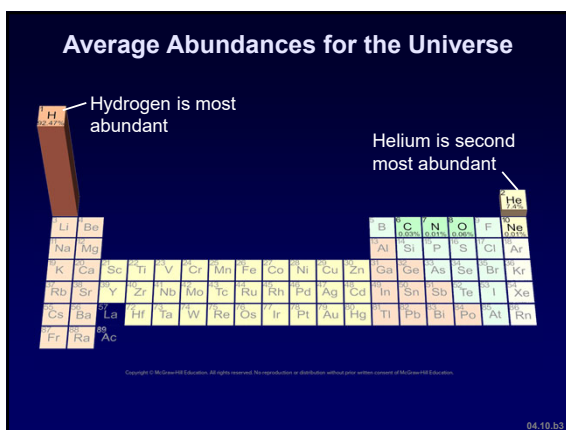
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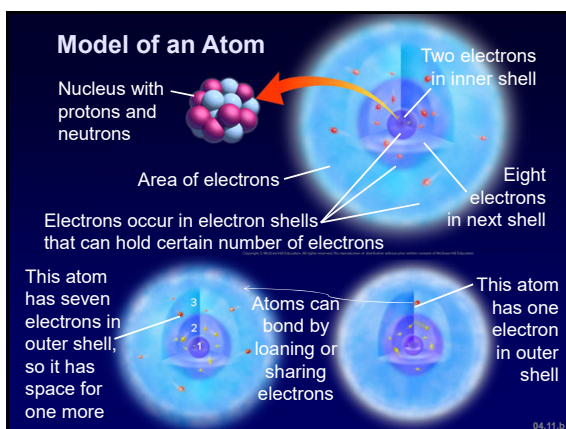
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**Periodic Table Is Organized by Electron Shells**  
Columns reflect number of electrons in outer shell

Rows reflect number of electron shells

Last column = outer shells filled for noble gases

04.11.c1

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**How Atoms Bond Together**

Sharing      Loaning

Covalent bond

Electron

Nucleus

Orbital Shells

Shared Electrons

Loaned Electron from Outer Shell of Na Atom

Electrical Attraction

Ionic bond

04.12.a

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**How Atoms Bond Together (cont.)**

Free flow      Stick together

Metallic bond

Nucleus

Electron

Strongly Bonded Sheets

Weak Bonds

Inter-molecular force

04.12.a

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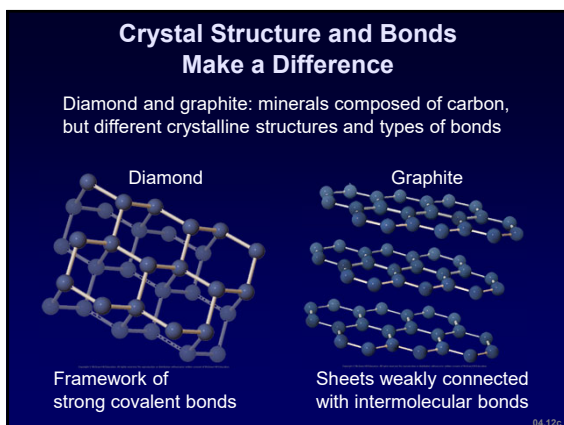
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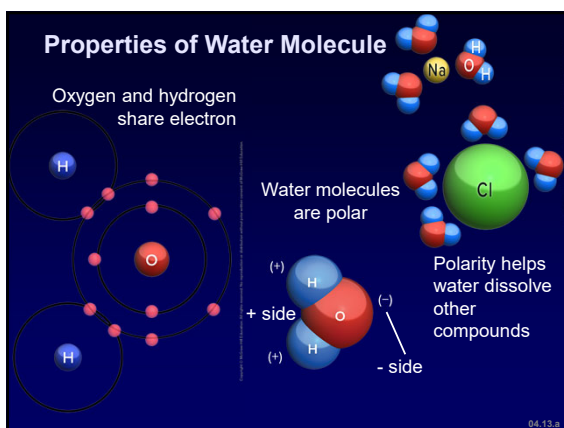
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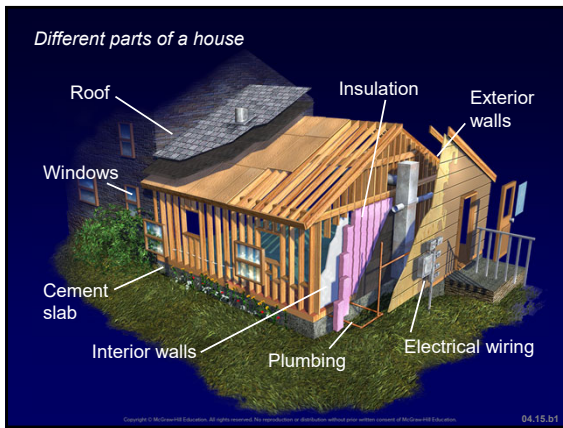
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