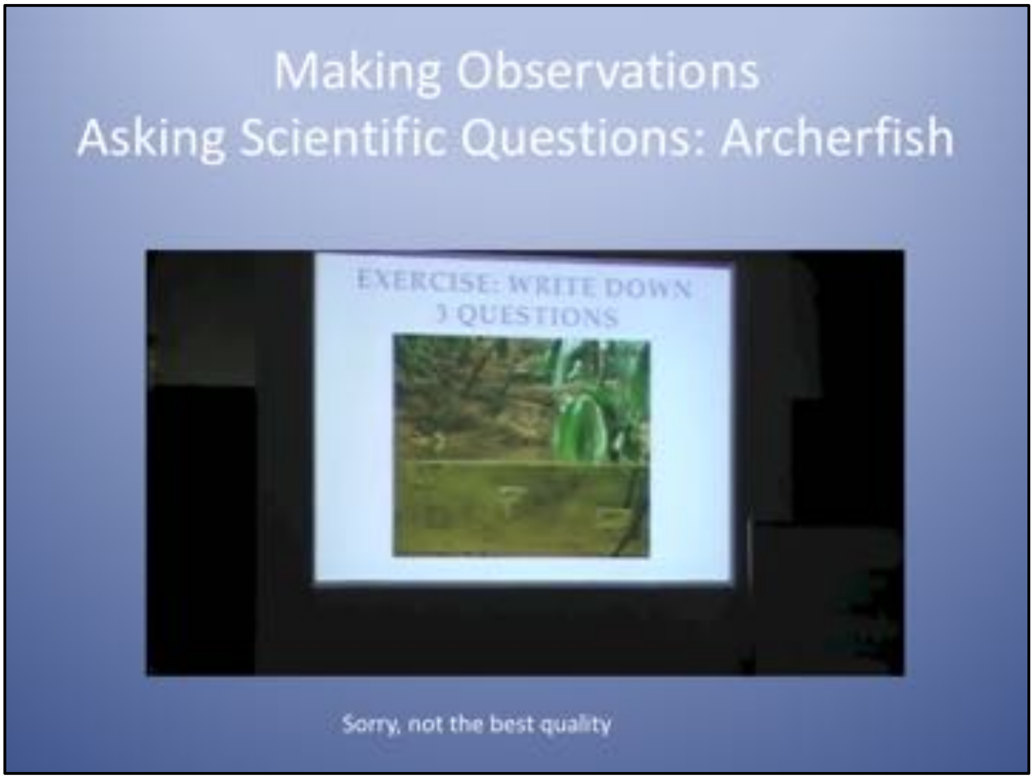

Welcome to AP Bio Lab
Sit where you'd like;
pick your partner

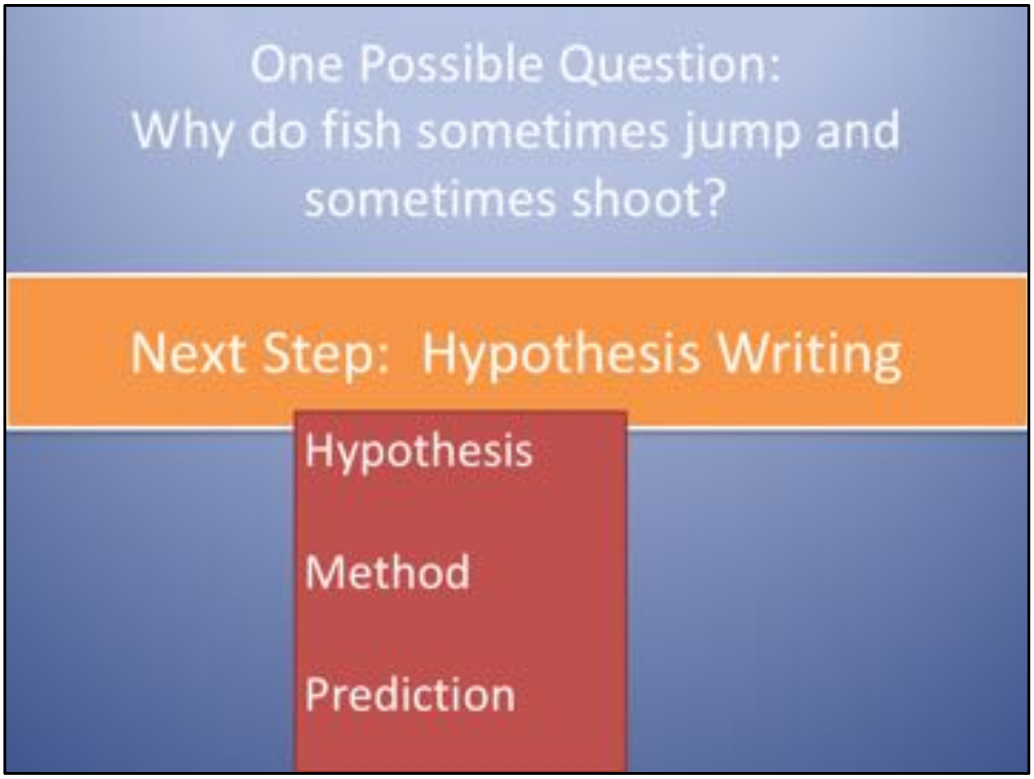


Write down 3 or more questions.

Your Questions

Questions Others Have Asked

- How do Fish detect prey?
- Why do fish sometimes shoot and sometimes jump for food?
- Why does shooter let another fish eat food?
- Do fish eat anything other than flies?
- How do fish eject water?
- How does ability to shoot for prey develop?
- Are fish born knowing how to shoot down flies?
- Do fish fight for food?
- Why do fish feed in groups – defense against predators?
- Can fish shoot at night?


One Possible Question:
Why do fish sometimes jump and sometimes shoot?
Next Step: Hypothesis Writing
Hypothesis
Method
Prediction

One Possible Question:
Why do fish sometimes jump and sometimes shoot?

Next Step: Hypothesis Writing
Write 3 possible hypotheses

- Declarative sentences
- Possible answers to THIS question
- Don't propose answers to a different question

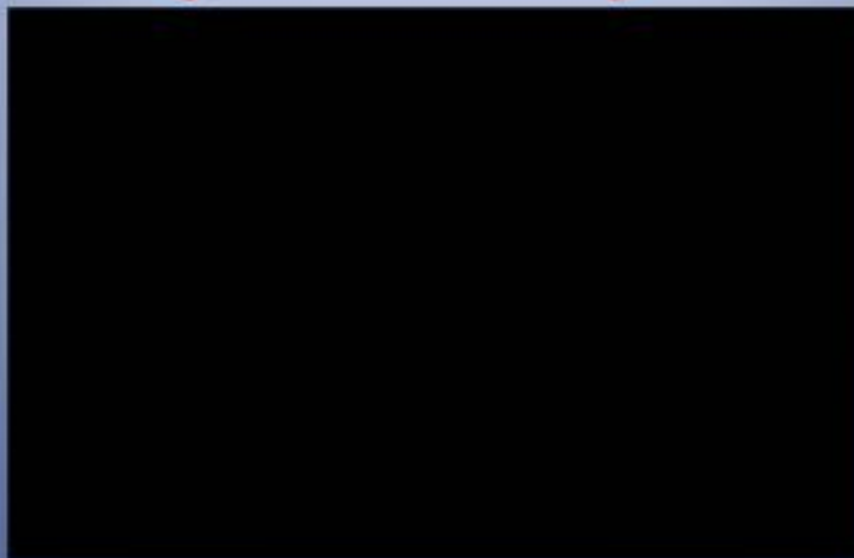
Your Hypotheses

What make them good hypotheses? → TESTABLE
What observations do they predict if true? (could be several things)
Support/ not support hypothesis

TESTABLE HYPOTHESES

- Hypotheses lead to testable predictions.
- What would we expect to see if a hypothesis is true?
- Predictions allows us to collect evidence for or against a hypothesis and lead to an experimental design.
- Hypotheses are then supported or not supported by the evidence collected.

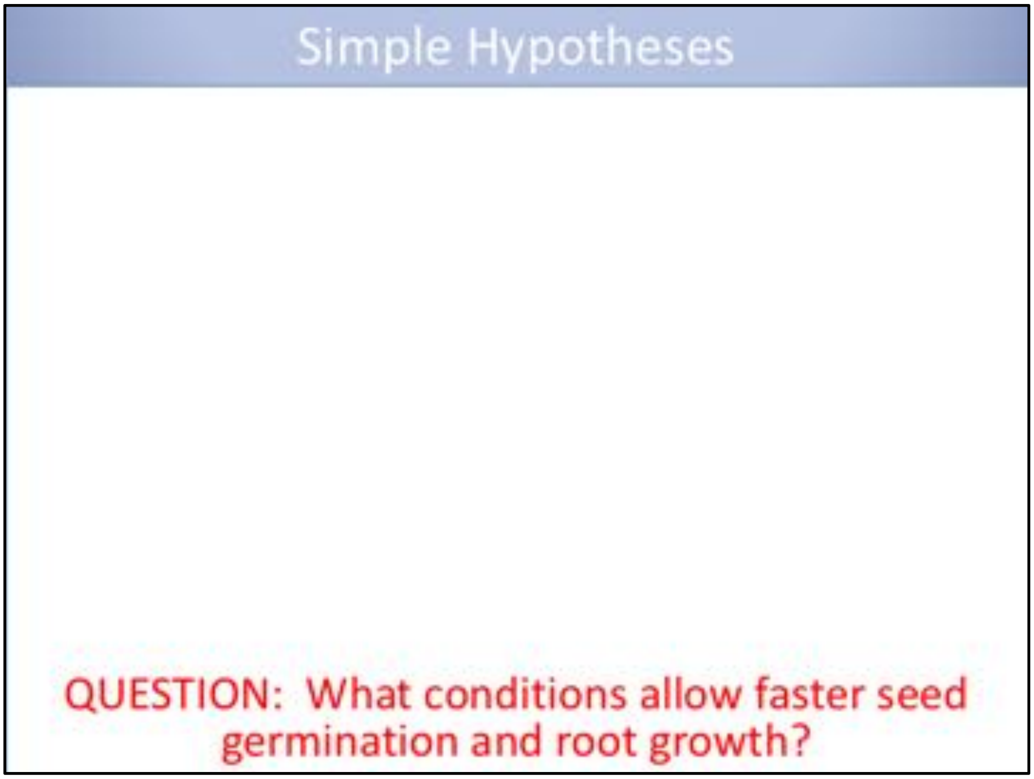
QUESTION: What conditions allow faster seed germination and root growth?



Bean Seed Germinating


Mung Bean Germinating

Radish Seeds Germinating

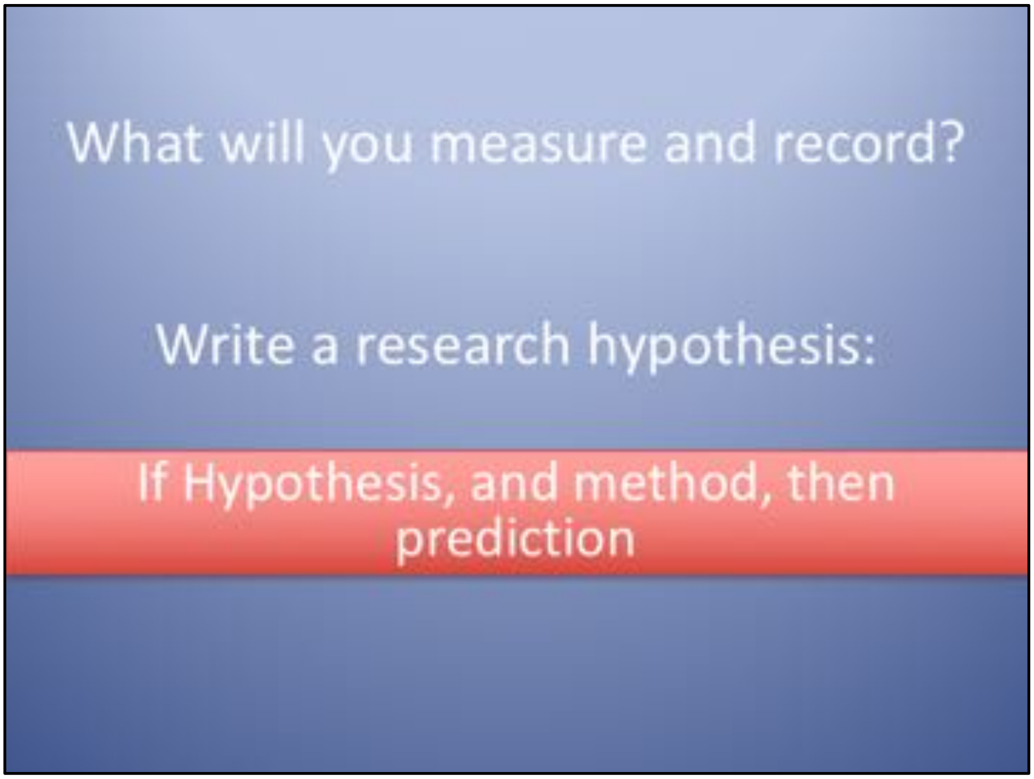


Color of light, ph, dark, temperature, GA, salt, fertilizer, scarification

Seed Germination Variables

1. _______ (color) light –
2. Light Intensity
3. Acidic pH –
4. Dark (exposure to light) –
5. Colder Temperature –
6. Presence of Gibberellic Acid (1mg/l) –
7. Presence of Salt (5%) (Type of water) –
8. Presence Fertilizer (7 drops/L Schultz brand) –
9. Scarification (Shaking in sand)–
10. Type of seed –
11. Size of seed (hard to do)
12. Amount of Moisture (simple = access to water) -


Experiment Set Up
Constants/ Independent Variable/ Dependent Variable
WHAT WILL BE YOUR CONTROL SET UP?


What will you measure and record?
Write a research hypothesis:
If Hypothesis, and method, then prediction

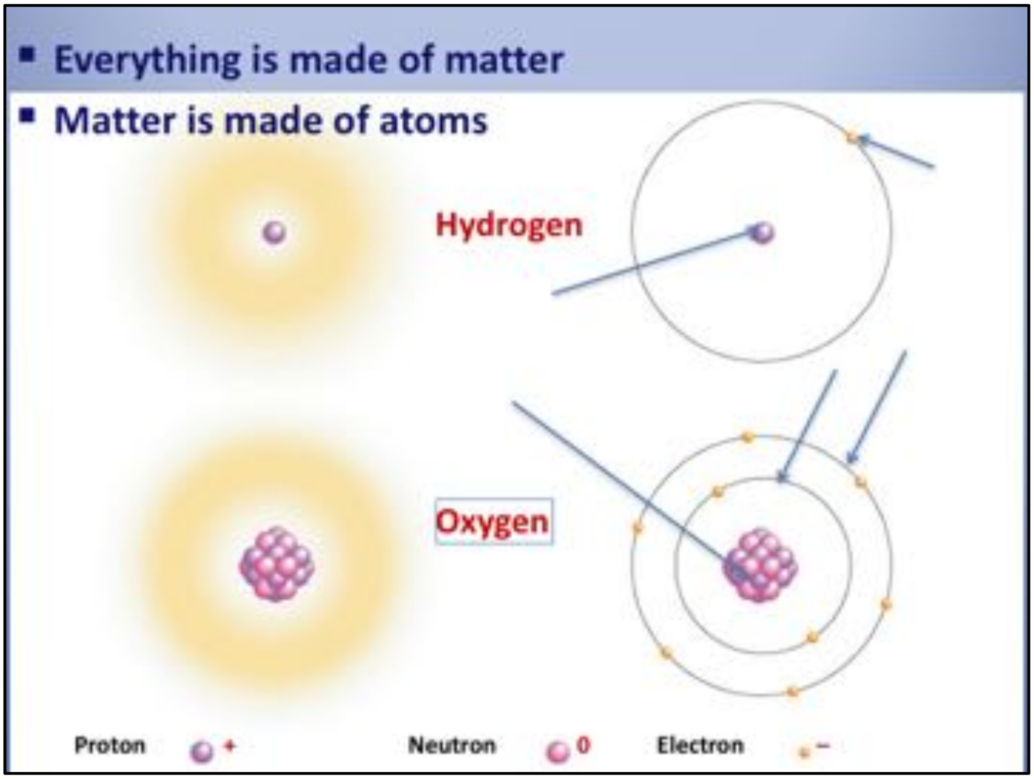
EXTRA:Corn Seed Germinating

Gather Seed Germination Data

- Count the number of seeds that have germinated.
- Make sure you can see the radicle. If questionable, count this seed as not germinated.
- Bags will have condensation that will make seeing difficult.
- Magnifying glasses are available to help.


Example Seeds Needing Scarifcation
Morning Glory
Cannis
Purple hyacinth beans

Review: Chemistry for Biologists



Everything is made of matter
Matter is made of atoms
Hydrogen
Oxygen
Proton +
Neutron 0
Electron –

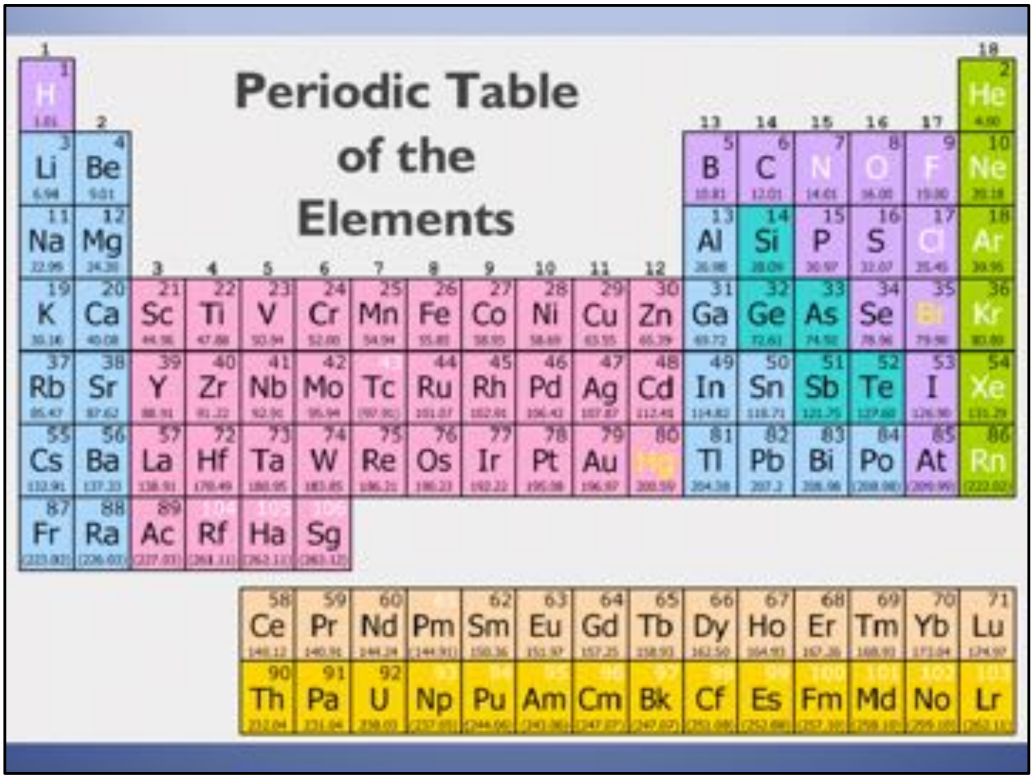

Periodic Table
of the
Elements
1 H
2 He
3 Li 4 Be
5 B 6 C 7 N 8 O 9 F 10 Ne
11 Na 12 Mg
13 Al 14 Si 15 P 16 S 17 Cl 18 Ar
19 K 20 Ca 21 Sc 22 Ti 23 V 24 Cr 25 Mn 26 Fe 27 Co 28 Ni 29 Cu 30 Zn 31 Ga 32 Ge 33 As 34 Se 35 Br 36 Kr
37 Rb 38 Sr 39 Y 40 Zr 41 Nb 42 Mo 43 Tc 44 Ru 45 Rh 46 Pd 47 Ag 48 Cd 49 In 50 Sn 51 Sb 52 Te 53 I 54 Xe
55 Cs 56 Ba 57 La 72 Hf 73 Ta 74 W 75 Re 76 Os 77 Ir 78 Pt 79 Au 80 Hg 81 Tl 82 Pb 83 Bi 84 Po 85 At 86 Rn
87 Fr 88 Ra 89 Ac 104 Rf 105 Ha 106 Sg
58 Ce 59 Pr 60 Nd 61 Pm 62 Sm 63 Eu 64 Gd 65 Tb 66 Dy 67 Ho 68 Er 69 Tm 70 Yb 71 Lu
90 Th 91 Pa 92 U 93 Np 94 Pu 95 Am 96 Cm 97 Bk 98 Cf 99 Es 100 Fm 101 Md 102 No 103 Lr

TABLE 2.1 CHEMICAL COMPOSITION OF THE HUMAN BODY

Symbol	Element	Percentage of Human Body Weight	
O	Oxygen	65.0	96.3
C	Carbon	18.5	
H	Hydrogen	9.5	
N	Nitrogen	3.3	
Ca	Calcium	1.5	
P	Phosphorus	1.0	
K	Potassium	0.4	
S	Sulfur	0.3	
Na	Sodium	0.2	
Cl	Chlorine	0.2	
Mg	Magnesium	0.1	

Trace elements (less than 0.01%): boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), and zinc (Zn).

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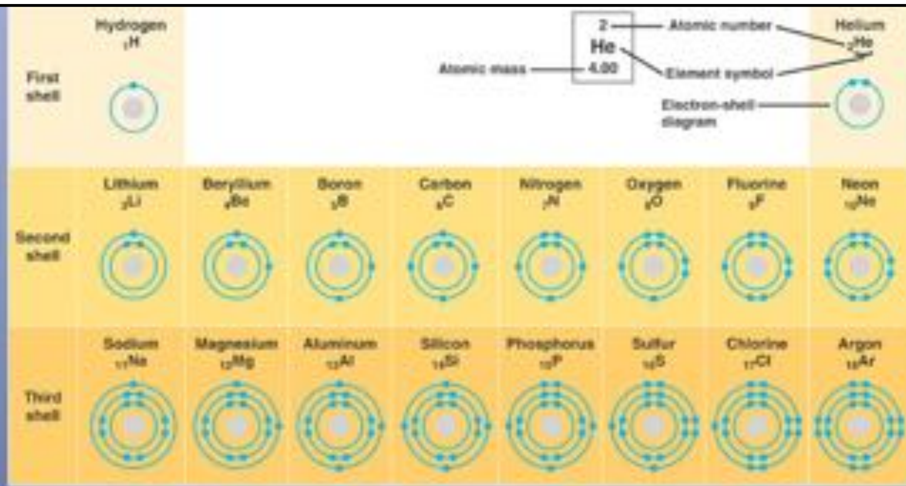
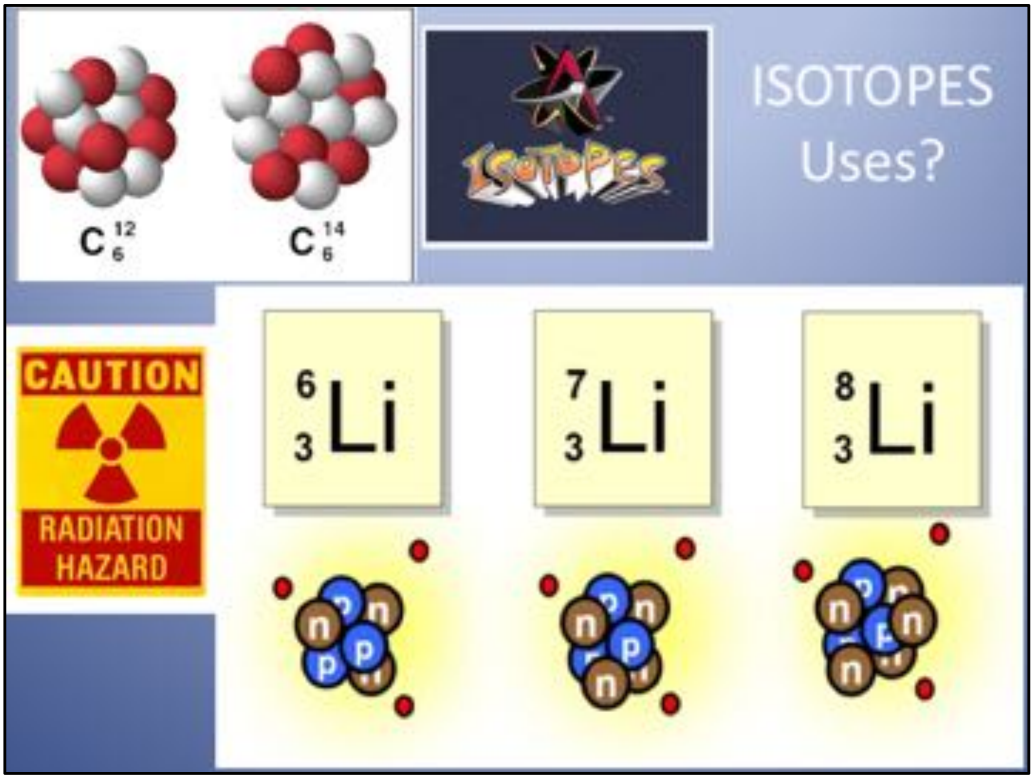
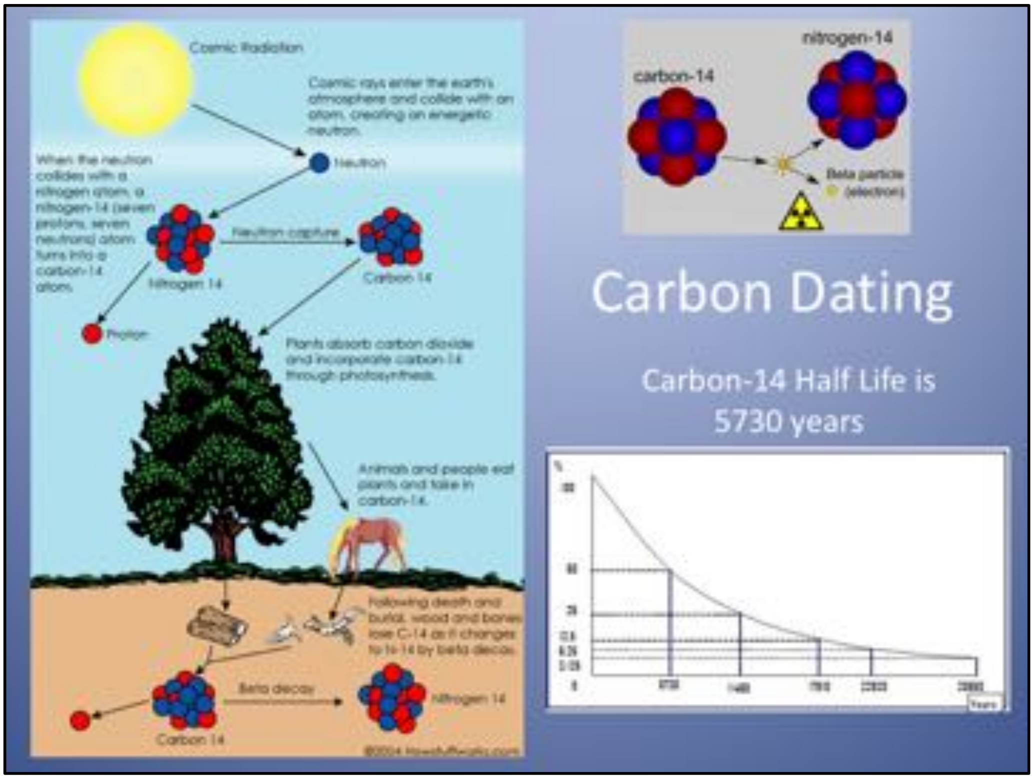


Atomic Number

Atomic Mass

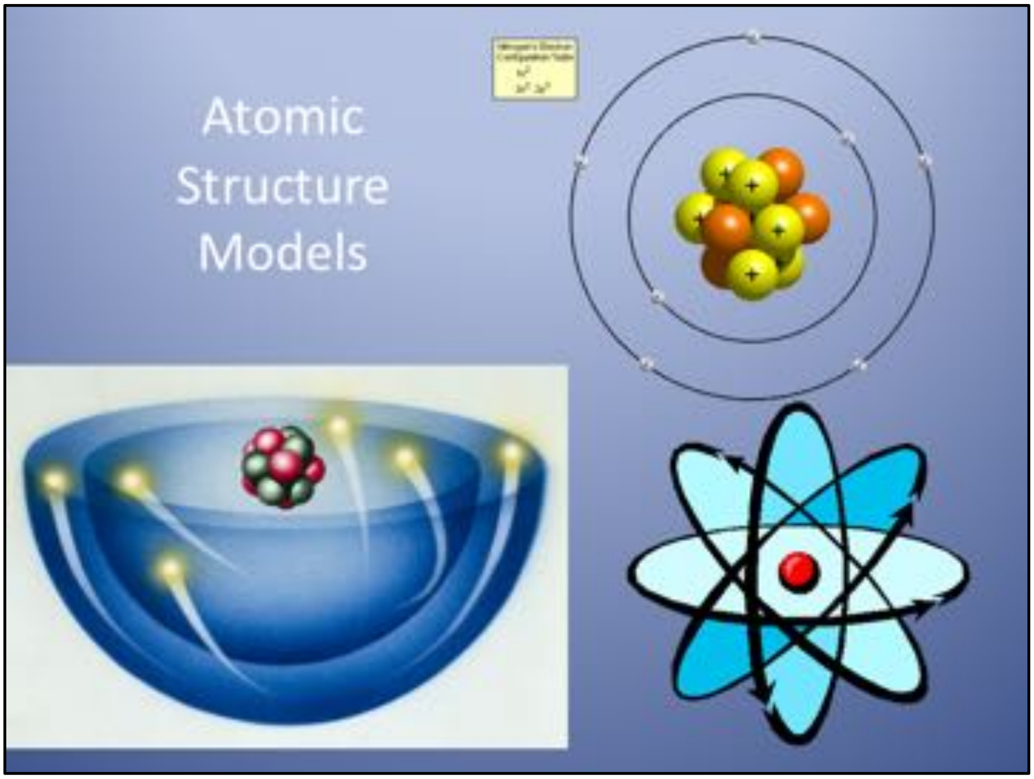


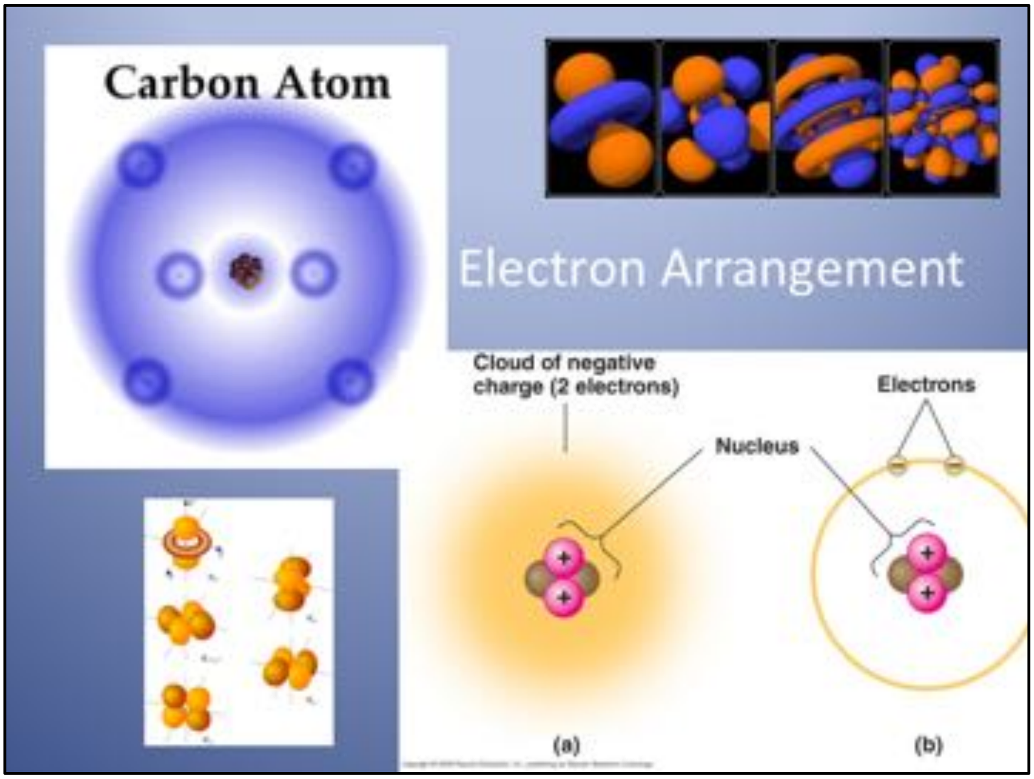
Tracers, Medicine, PET Scans, Radioactive Dating



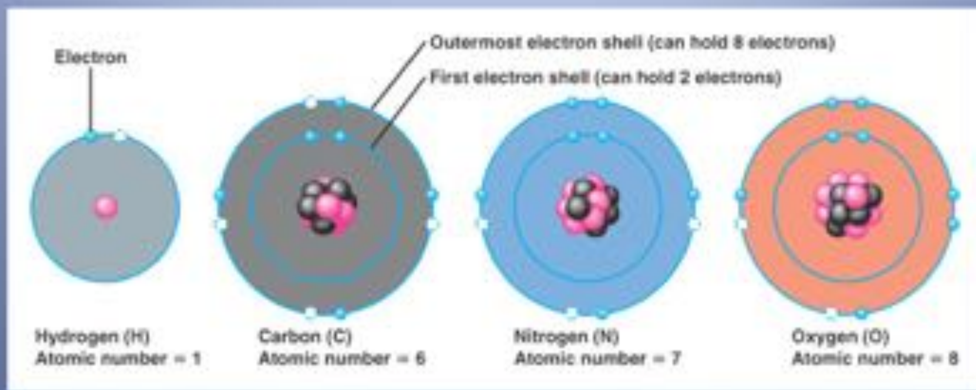
The carbon-14 atoms that cosmic rays create combine with oxygen to form carbon dioxide, which plants absorb naturally and incorporate into plant fibers by photosynthesis. Animals and people eat plants and take in carbon-14 as well. The ratio of normal carbon (carbon-12) to carbon-14 in the air and in all living things at any given time is nearly constant. Maybe one in a trillion carbon atoms are carbon-14. The carbon-14 atoms are always decaying, but they are being replaced by new carbon-14 atoms at a constant rate. At this moment, your body has a certain percentage of carbon-14 atoms in it, and all living plants and animals have the same percentage.

As soon as a living organism dies, it stops taking in new carbon. The ratio of carbon-12 to carbon-14 at the moment of death is the same as every other living thing, but the carbon-14 decays and is not replaced. The carbon-14 decays with its half-life of 5,700 years, while the amount of carbon-12 remains constant in the sample. By looking at the ratio of carbon-12 to carbon-14 in the sample and comparing it to the ratio in a living organism, it is possible to determine the age of a formerly living thing fairly precisely.A formula to calculate how old a sample is by carbon-14 dating is:**t = [ln (Nf/No) / (-0.693)] x t1/2**

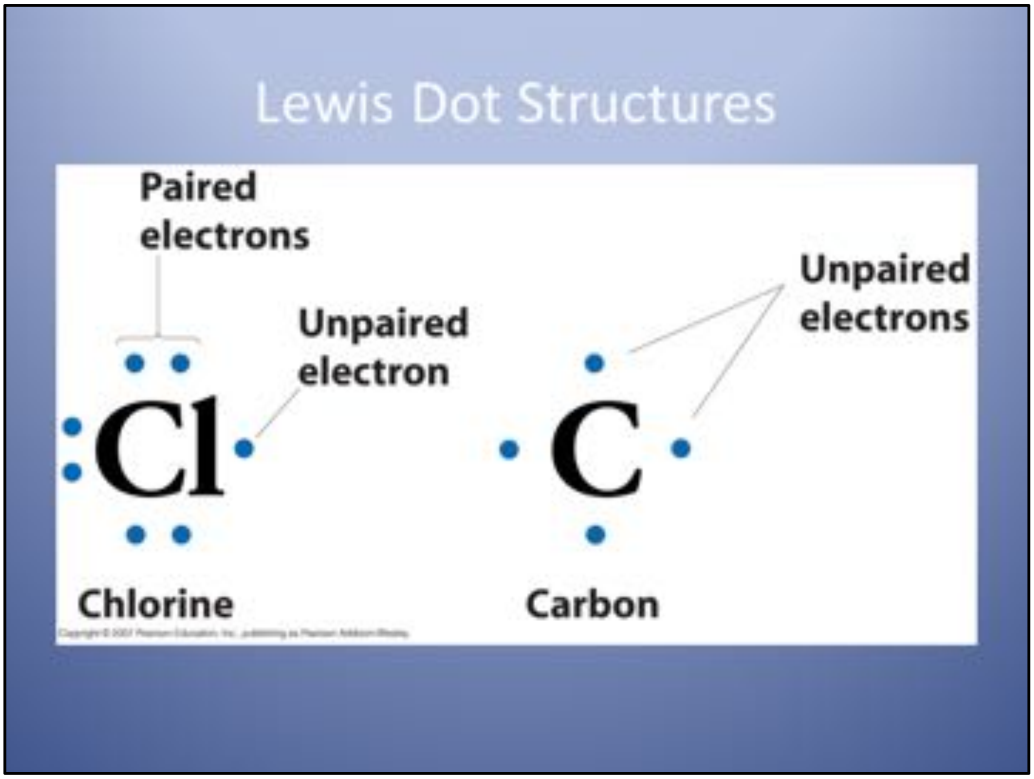

Atomic
Structure
Models


Carbon Atom
Electron Arrangement
Cloud of negative charge (2 electrons)
Electrons
Nucleus
(a)
(b)

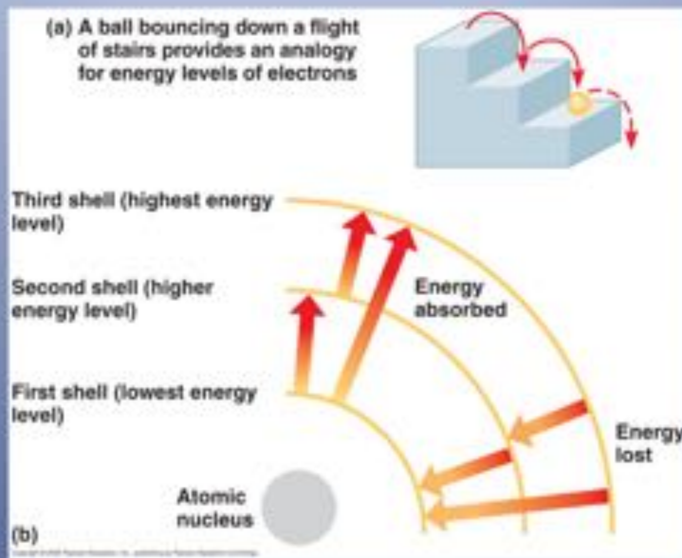
Outermost Electron Shell



Valence Shell

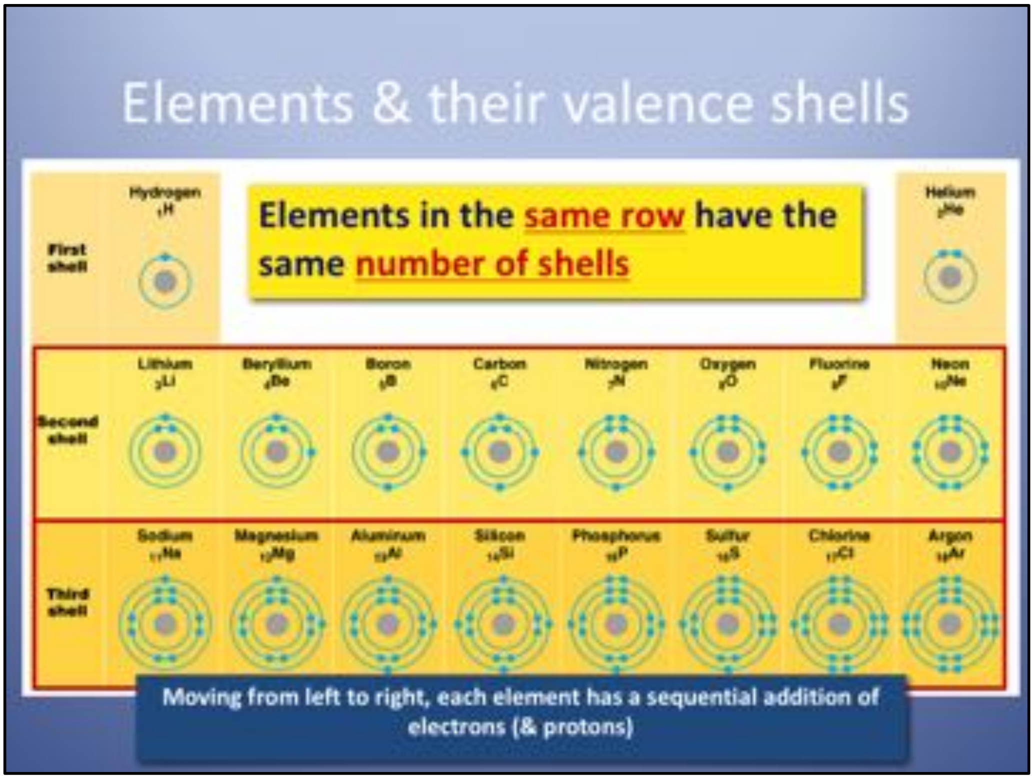

Lewis Dot Structures
Paired electrons
Unpaired electron
Cl
Chlorine
Unpaired electrons
C
Carbon

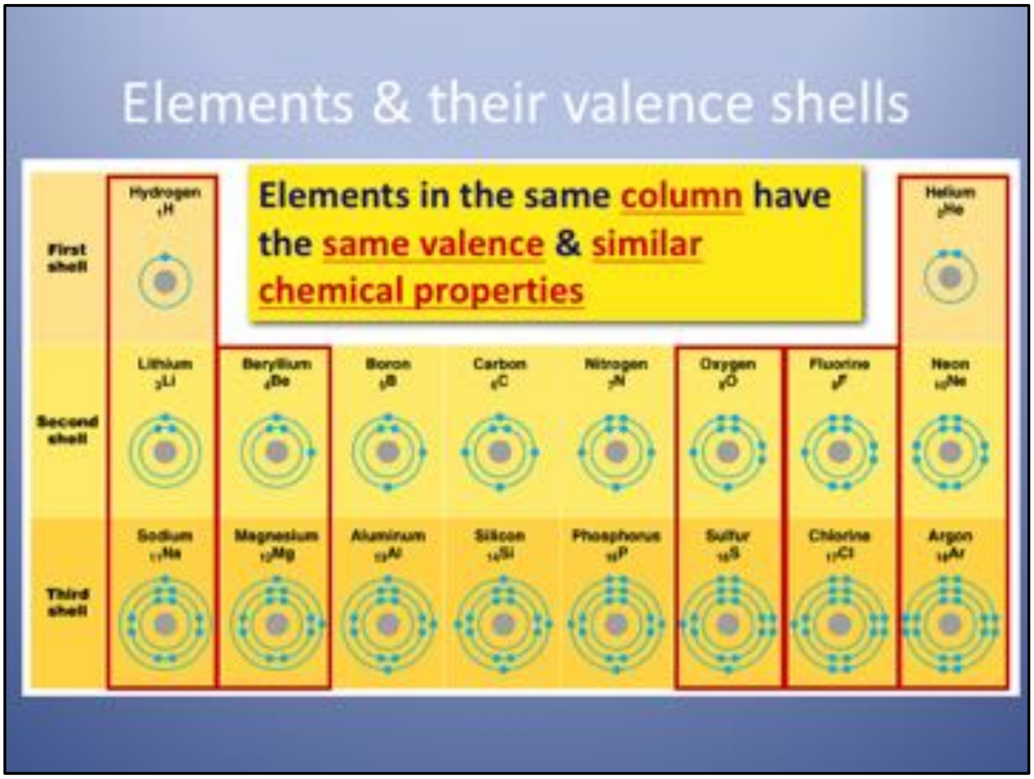
Energy Levels: Energy of Position



Electrons in the outermost shell

	Group 1	2	3	4	5	6	7	0	Number of occupied shells
Period 1								2 He 2	1
Period 2	3 Li 2,1	4 Be 2,2	5 B 2,3	6 C 2,4	7 N 2,5	8 O 2,6	9 F 2,7	10 Ne 2,8	2
Period 3	11 Na 2,8,1	12 Mg 2,8,2	13 Al 2,8,3	14 Si 2,8,4	15 P 2,8,5	16 S 2,8,6	17 Cl 2,8,7	18 Ar 2,8,8	3
Period 4	19 K 2,8,8,1	20 Ca 2,8,8,2							4
Number of electrons in outer shell	1	2	3	4	5	6	7	8 (except for helium)	


Elements & their valence shells
Elements in the same row have the same number of shells
First shell
Hydrogen
Helium
Second shell
Lithium
Beryllium
Boron
Carbon
Nitrogen
Oxygen
Fluorine
Neon
Third shell
Sodium
Magnesium
Aluminum
Silicon
Phosphorus
Sulfur
Chlorine
Argon
Moving from left to right, each element has a sequential addition of electrons (& protons)



Oxygen has medium electronegativity so doesn't pull electrons all the way off hydrogen whereas chlorine would.
So oxygen forms a polar covalent bond.

Carbon has only a weak electronegativity so forms a nonpolar covalent bond

Chemical reactivity

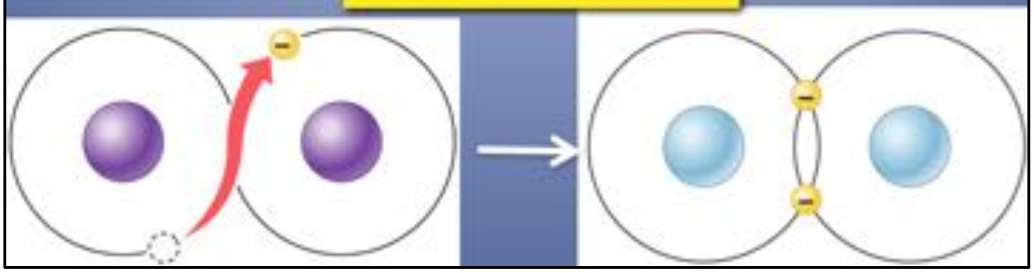
- Atoms tend to
  - complete a partially filled valence shell

    or

  - empty a partially filled valence shell

This tendency drives chemical reactions…

and creates bonds




Electronegativity

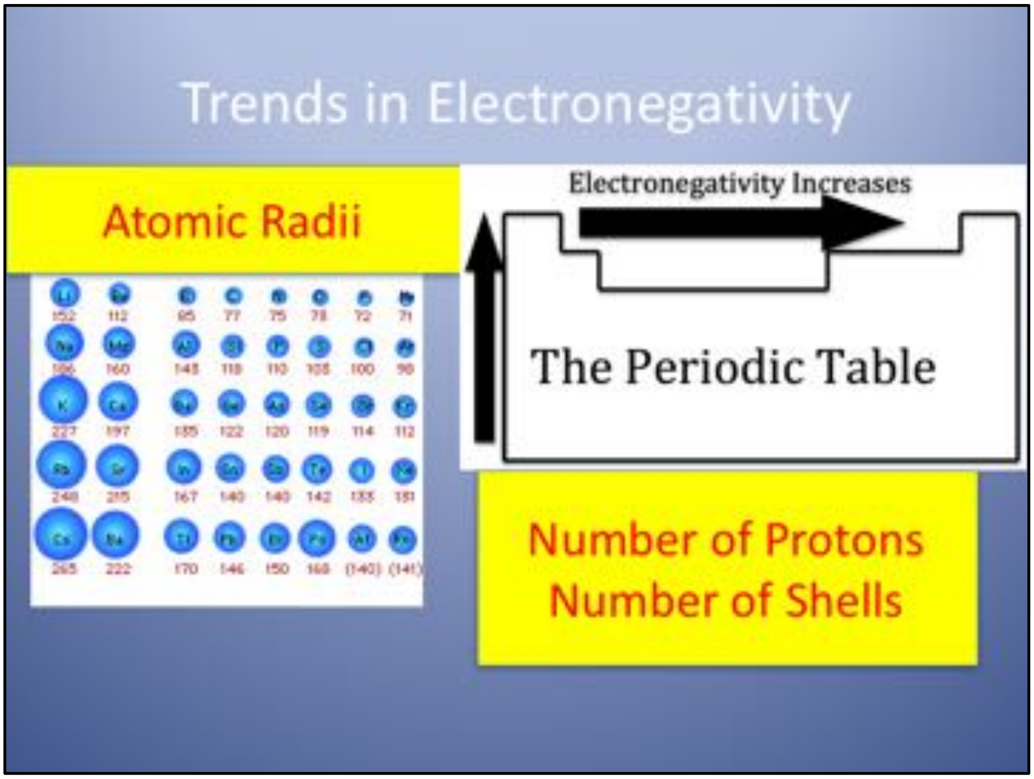
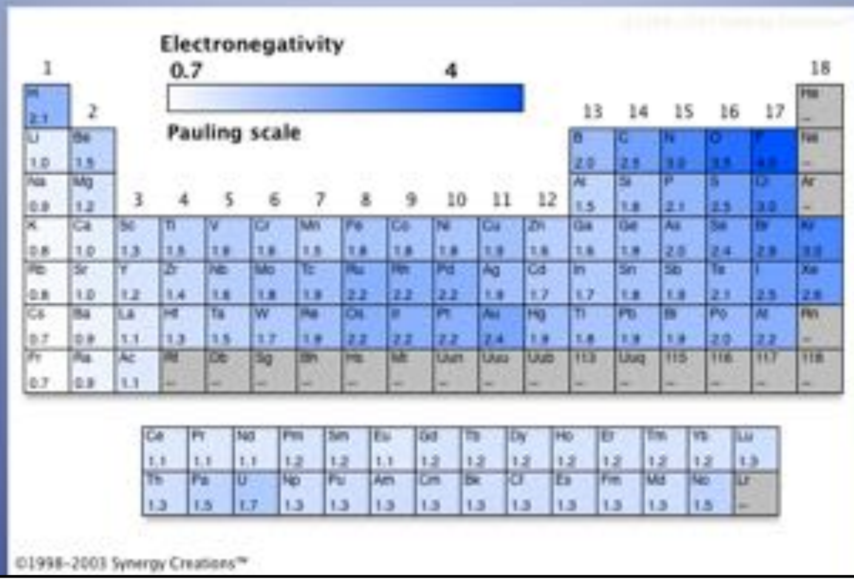
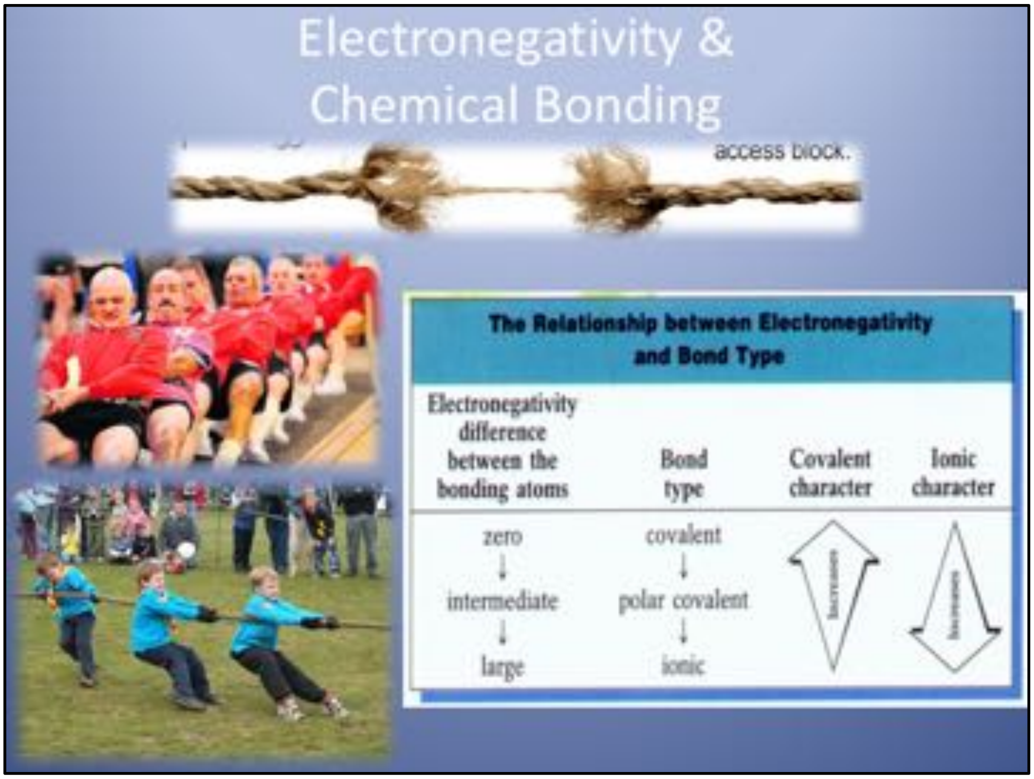

Trends in Electronegativity
Atomic Radii
Electronegativity Increases
The Periodic Table
Number of Protons
Number of Shells

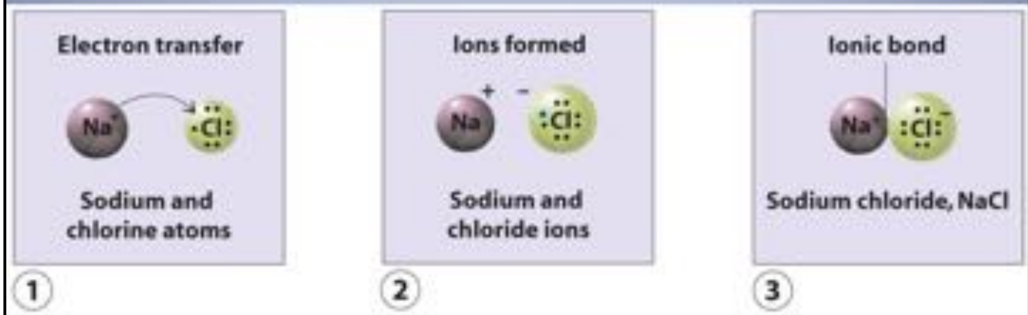
Table of Electronegativity Values – See Binder Page





The rule is that when the electronegativity difference is greater than 2.0, the bond is considered ionic.So, let's review the rules:1. If the electronegativity difference (usually called ΔEN) is less than 0.5, then the bond is nonpolar covalent.2. If the ΔEN is between 0.5 and 1.6, the bond is considered polar covalent3. If the ΔEN is greater than 2.0, then the bond is ionic.That, of course, leaves us with a problem. What about the gap between 1.6 and 2.0? So, rule #4 is:4. If the ΔEN is between 1.6 and 2.0 and if a metal is involved, then the bond is considered ionic. If only nonmetals are involved, the bond is considered polar covalent.

Ionic Bonding



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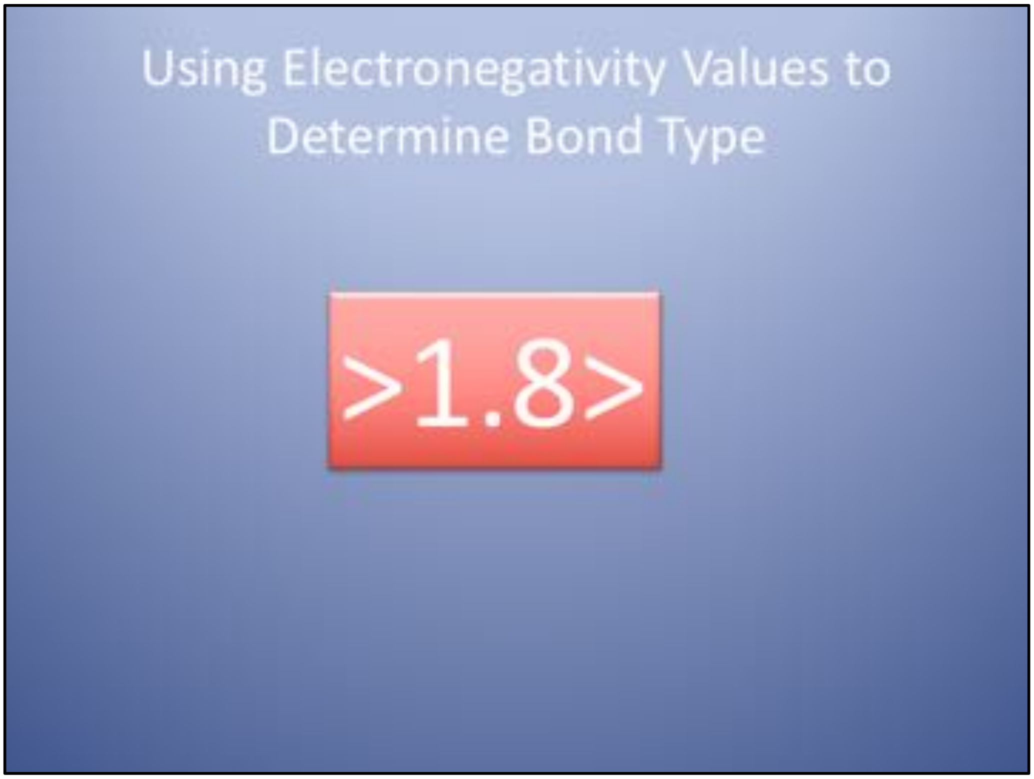


From: http://www.chemteam.info/Bonding/Electroneg-Bond-Polarity.html

So, let's review the rules:
1. If the electronegativity difference (usually called ΔEN) is less than 0.5, then the bond is nonpolar covalent.
2. If the ΔEN is between 0.5 and 1.6, the bond is considered polar covalent
3. If the ΔEN is greater than 2.0, then the bond is ionic.
That, of course, leaves us with a problem. What about the gap between 1.6 and 2.0? So, rule #4 is:
4. If the ΔEN is between 1.6 and 2.0 and if a metal is involved, then the bond is considered ionic. If only nonmetals are involved, the bond is considered polar covalent.
Here is an example: Sodium bromide (formula = NaBr; EN_{Na} = 0.9, EN_{Br} = 2.8) has a ΔEN = 1.9.
Hydrogen fluoride (formula = HF; EN_{H} = 2.1, EN_{F} = 4.0) has the same ΔEN. We use rule #4 to decide that NaBr has ionic bonds and that HF has a polar covalent bond in each HF molecule.
As you might expect, NaBr and HF are very different substances. NaBr exhibits the classic "lattice structure" of ionic substances whereas HF is a gas a room temperature.
A warning: rule #4 may not exist in your textbook. Often, the 1.6 value is used and the 1.6-2.0 range is lumped into the ionic category.

Another: https://www.chem.wisc.edu/deptfiles/genchem/sstutorial/Text7/Tx71/tx71.html

When two atoms combine, the nature of the bond between them is determined by the difference between their electronegativities (denoted EN). If the atoms forming the bond differ in electronegativity by more than 1.7 units, the bond will be at least 50% ionic (referred to as percent ionic character); we treat such a bond as wholly ionic. If the values differ by less than 0.4 units, we consider the bond to be wholly nonpolar. If the difference is between 0.4 and 1.7 electronegativity units, the bond is considered to be polar covalent. Remember that electronegativities have been calculated from fairly imprecise data for particular bonding situations. Electronegativity is useful in predicting the nature of a bond and for comparing bond types, but the prediction is only an approximation. Remember too that no sharp distinction exists between ionic, polar covalent, and nonpolar bonds; rather, they form a continuum. Even the most ionic bond (between cesium and fluorine) has some covalent character, and only bonds between atoms of the same element have no ionic character.

For dummies.com said the cutoff was 1.5

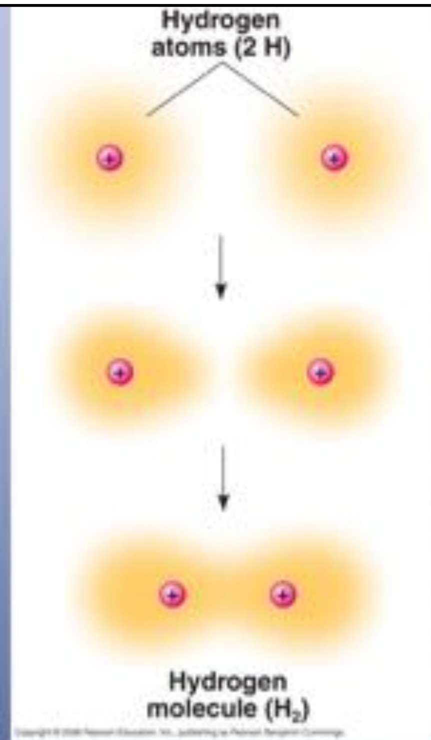
Another teacher siad the cutoff was 2.0

Another, http://chemsite.lsrhs.net/ChemicalBonds/electronegativity.html, said cutoff is 2.1

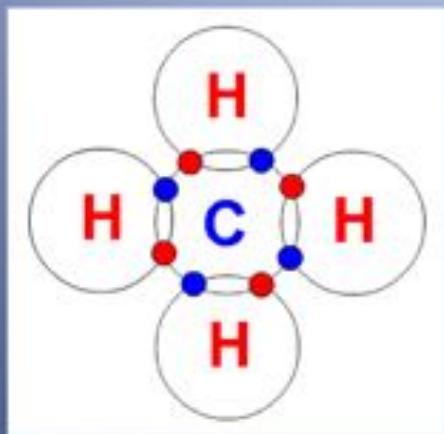
Covalent Bonding

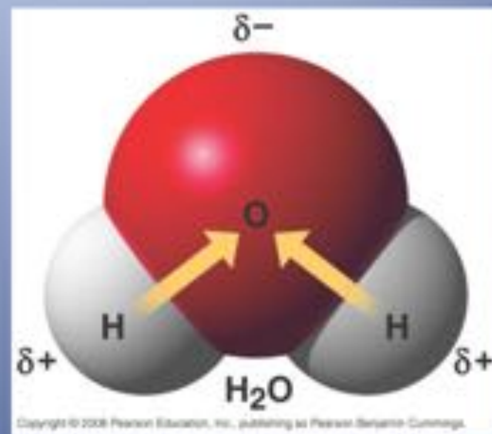
Do Examples:

Hydrogen gas
Oxygen gas
Methane
Water



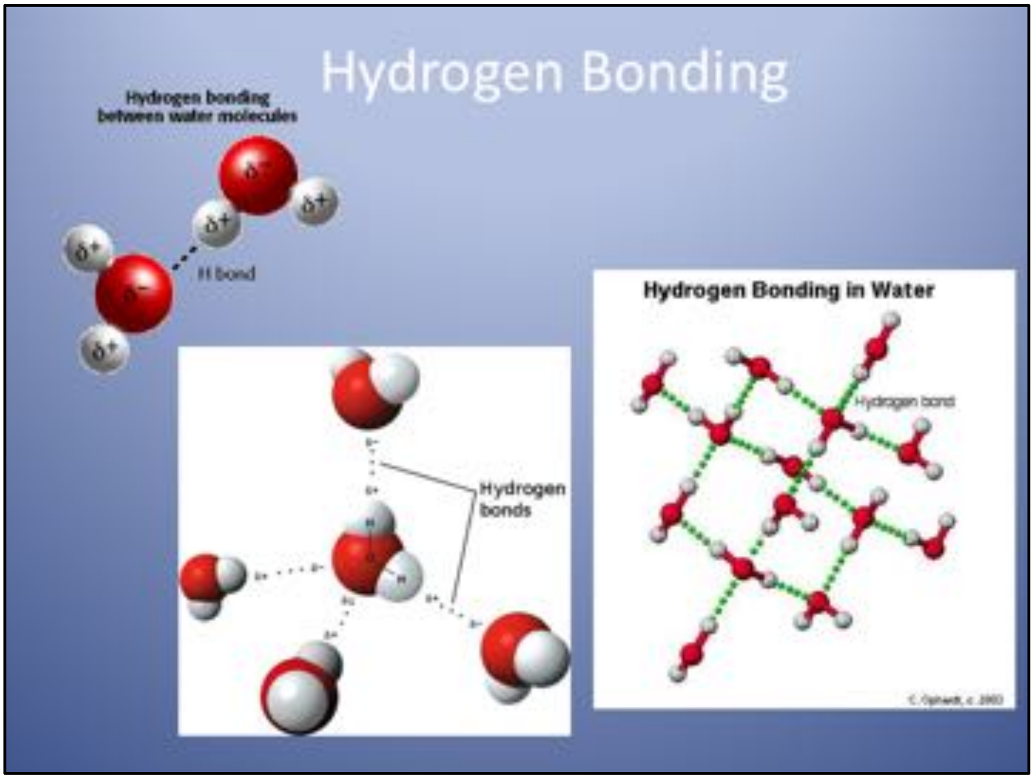
Non Polar v. Polar Covalent Bonds



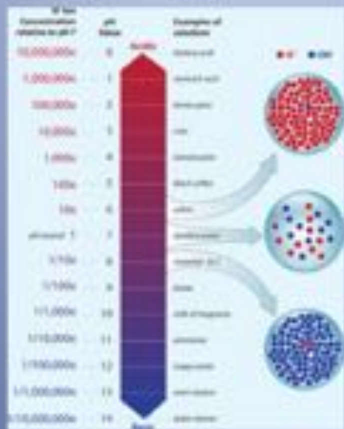


Using Electronegativity Values to Determine Bond Type AND Polar vs. Non-Polar Covalent Bonds (just general)

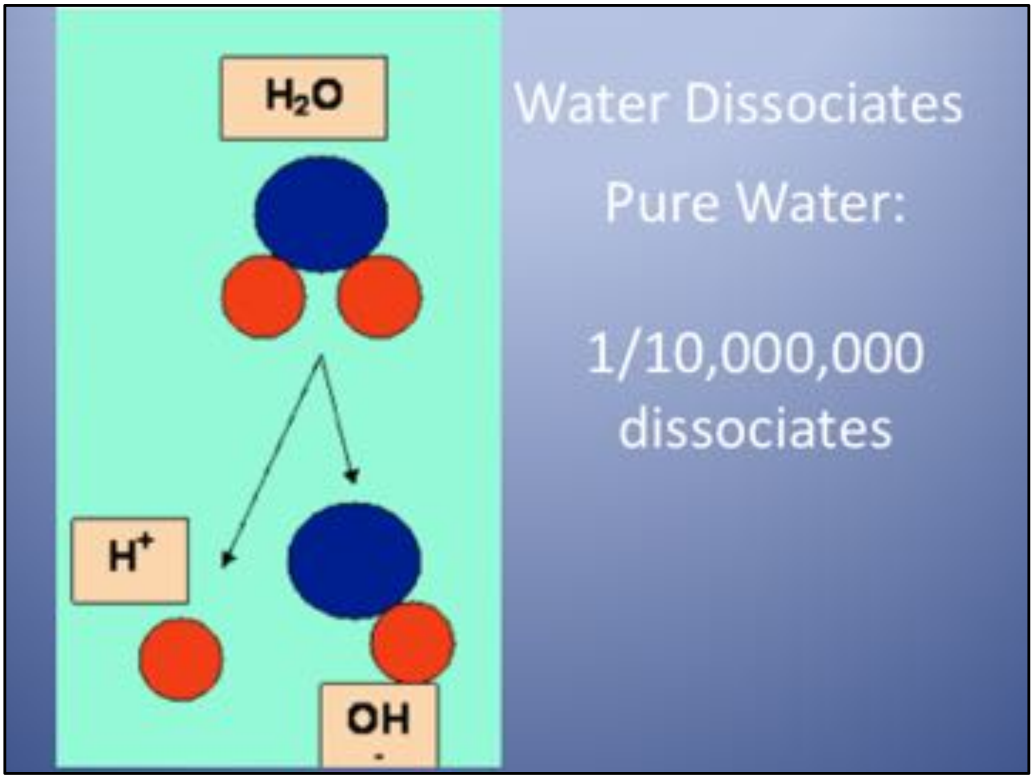
> 1.8 > 0.9 >

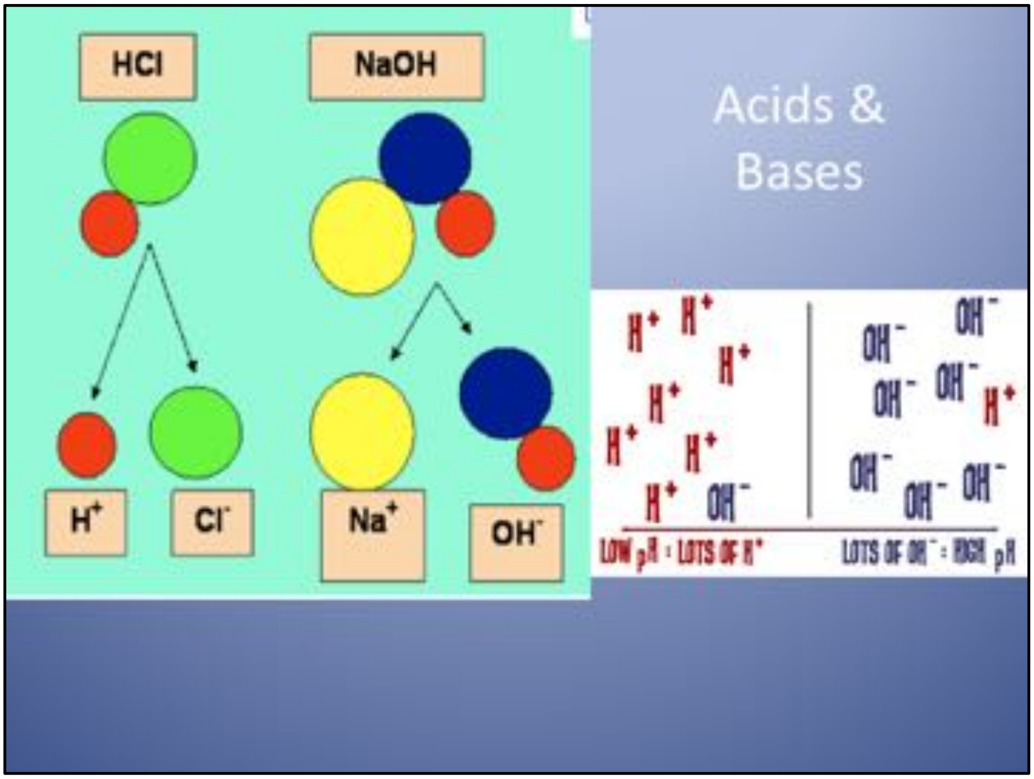

Hydrogen Bonding
Hydrogen bonding between water molecules
H bond
Hydrogen bonds
Hydrogen Bonding in Water
Hydrogen bond

Let's Explore Water




pH?


Water Dissociates
Pure Water:
1/10,000,000
dissociates
H2O
H+
OH



Acids - Add more H+ ions

Bases – Remove H+ by Adding OH-

Table 1. Correlation of pH values and Hydronium ion concentrations

pH	Hydronium ion concentration (moles/L)	
1	.1	(1×10^{-1})
2	.01	(1×10^{-2})
3	.001	(1×10^{-3})
4	.0001	(1×10^{-4})
5	.00001	(1×10^{-5})
6	.000001	(1×10^{-6})
7	.0000001	(1×10^{-7})
8	.00000001	(1×10^{-8})
9	.000000001	(1×10^{-9})
10	.0000000001	(1×10^{-10})
11	.00000000001	(1×10^{-11})
12	.000000000001	(1×10^{-12})
13	.0000000000001	(1×10^{-13})
14	.00000000000001	(1×10^{-14})


Concentration of Hydrogen ions compared to distilled water
Examples of solutions and their respective pH
14
13
12
11
10
0
Soapy water
Battery Acid


ACID RAIN
$SO_2 \rightarrow H_2SO_4$
$NO_x \rightarrow HNO_3$
Dry Deposition
(particulates and gases)
Wet Deposition
(rain, snow, sleet)
SO_2
NO_x
NO_x
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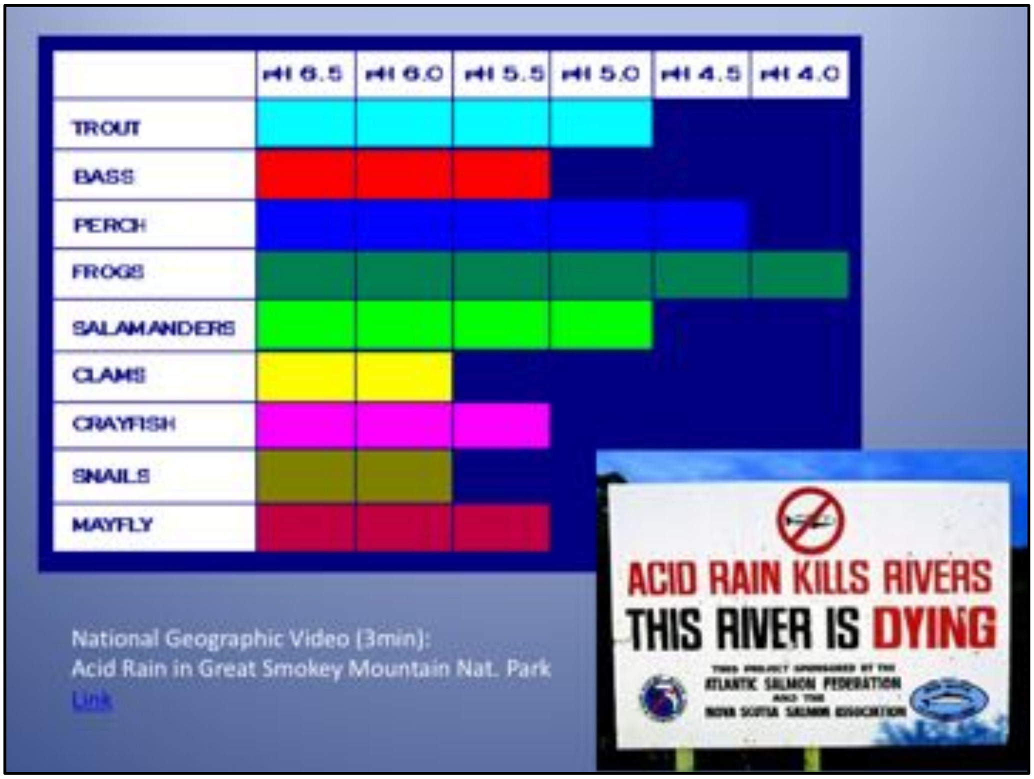
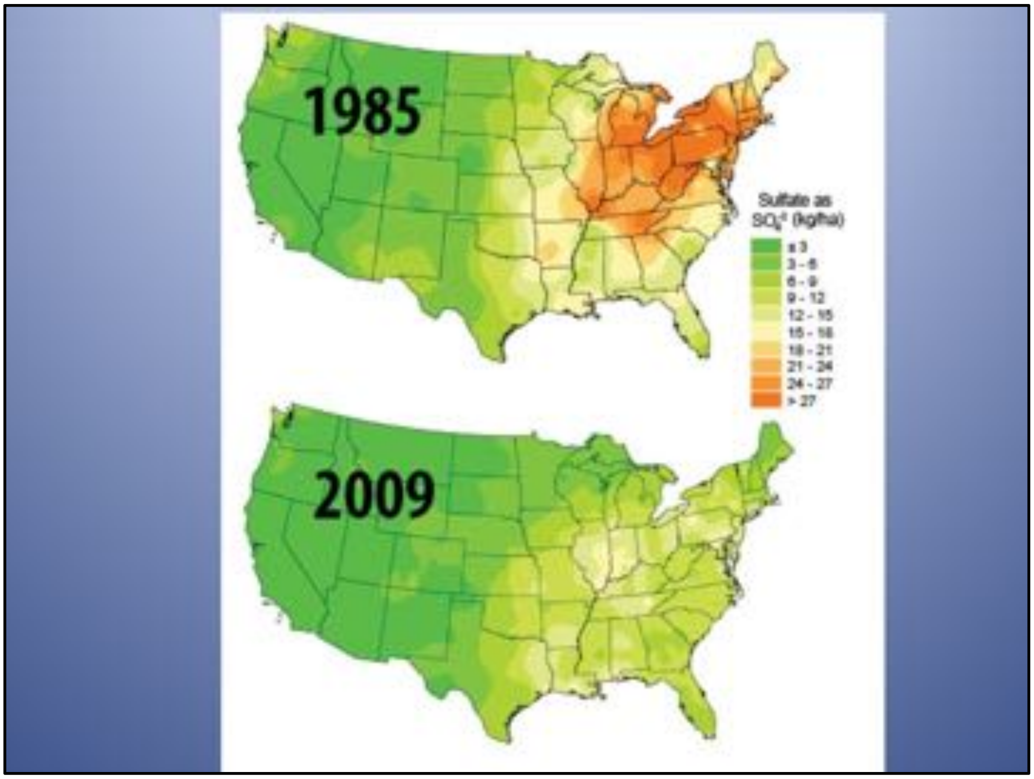
Prevents uptake of nutrients from soil
Even slight damage to a mature tree caused by pollution can be enough to kill it because it reduces the trees frost hardiness and its resistance to fungal and pest attack
Acid rain can also damage buildings and historic monuments and statues, especially those made of rocks, such as limestone and marble, that contain large amounts of calcium carbonate. Acids in the rain react with the calcium compounds in the stones to create gypsum, which then flakes off.



http://channel.nationalgeographic.com/channel/videos/acid-rain-invisible-menace/



U.S. sulfur deposition, shown in orange in the 1985 map, has been drastically reduced due in part to acid rain cleanup. Hay growers should now tissue test for sulfur, soil fertility experts say. Maps: National Atmospheric Deposition Program

http://hayandforage.com/hay/alfalfa-need-nutrients-0501

http://www.epa.gov/airmarkt/progress/ARP_4.html

See water ppt for Calcification activity