

Basic Chemistry Review

AND

Properties of Water

TEKS

- No high school TEKS for properties of water
- You need to know them to understand how water helps to create a phospholipid bilayer (Cell/Plasma Membrane) for TEKS 4B

Vocabulary

- Valence Electron
- Polar/Polarity
- Hydrogen Bonding
- Cohesion
- Adhesion
- Hydrophobic
- Hydrophilic

Prerequisite Questions

- What is the chemical formula for Water?
- What are the 3 states of matter? (What do you call water at each state?)
- What happens to a chemical when it moves from one state to another at the molecular level?
- What can you state about two oppositely charged particles?
- What about two similarly charged particles?

Periodic Table Review

Periodic Table of the Elements

Atomic Number	Atomic Mass
Symbol Name	
Electron Shells	
Electron Configuration	

Element symbol represents state at room temperature.
Solid, Liquid or Gas

Period	1 IA 1A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9 VIII 9	10 VIII 10	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A																		
1	1 H Hydrogen 1 1.008												2 He Helium 2 4.003																							
2	3 Li Lithium 2.1 [He]2s ¹	4 Be Beryllium 2.4 [He]2s ²												5 B Boron 2.3 [He]2s ² 2p ¹	6 C Carbon 2.4 [He]2s ² 2p ²	7 N Nitrogen 2.5 [He]2s ² 2p ³	8 O Oxygen 2.6 [He]2s ² 2p ⁴	9 F Fluorine 2.7 [He]2s ² 2p ⁵	10 Ne Neon 2.8 [He]2s ² 2p ⁶																	
3	11 Na Sodium 2.8.1 [Ne]3s ¹	12 Mg Magnesium 2.8.2 [Ne]3s ²	13 Al Aluminum 2.8.3 [Ne]3s ² 3p ¹	14 Si Silicon 2.8.4 [Ne]3s ² 3p ²	15 P Phosphorus 2.8.5 [Ne]3s ² 3p ³	16 S Sulfur 2.8.6 [Ne]3s ² 3p ⁴	17 Cl Chlorine 2.8.7 [Ne]3s ² 3p ⁵	18 Ar Argon 2.8.8 [Ne]3s ² 3p ⁶	19 K Potassium 2.8.8.1 [Ar]4s ¹	20 Ca Calcium 2.8.8.2 [Ar]4s ²	21 Sc Scandium 2.8.8.9 [Ar]3d ¹ 4s ²	22 Ti Titanium 2.8.8.10 [Ar]3d ² 4s ²	23 V Vanadium 2.8.8.11 [Ar]3d ³ 4s ²	24 Cr Chromium 2.8.8.13 [Ar]3d ⁵ 4s ¹	25 Mn Manganese 2.8.8.14 [Ar]3d ⁵ 4s ²	26 Fe Iron 2.8.8.15 [Ar]3d ⁶ 4s ²	27 Co Cobalt 2.8.8.15 [Ar]3d ⁷ 4s ²	28 Ni Nickel 2.8.8.16 [Ar]3d ⁸ 4s ²	29 Cu Copper 2.8.8.16 [Ar]3d ¹⁰ 4s ¹	30 Zn Zinc 2.8.8.16 [Ar]3d ¹⁰ 4s ²	31 Ga Gallium 2.8.8.16 [Ar]3d ¹⁰ 4s ² 4p ¹	32 Ge Germanium 2.8.8.16 [Ar]3d ¹⁰ 4s ² 4p ²	33 As Arsenic 2.8.8.16 [Ar]3d ¹⁰ 4s ² 4p ³	34 Se Selenium 2.8.8.16 [Ar]3d ¹⁰ 4s ² 4p ⁴	35 Br Bromine 2.8.8.16 [Ar]3d ¹⁰ 4s ² 4p ⁵	36 Kr Krypton 2.8.8.16 [Ar]3d ¹⁰ 4s ² 4p ⁶										
4	37 Rb Rubidium 2.8.8.16 [Kr]5s ¹	38 Sr Strontium 2.8.8.16 [Kr]5s ²	39 Y Yttrium 2.8.8.16 [Kr]4d ¹ 5s ²	40 Zr Zirconium 2.8.8.16 [Kr]4d ² 5s ²	41 Nb Niobium 2.8.8.16 [Kr]4d ⁴ 5s ¹	42 Mo Molybdenum 2.8.8.16 [Kr]4d ⁵ 5s ¹	43 Tc Technetium 2.8.8.16 [Kr]4d ⁵ 5s ²	44 Ru Ruthenium 2.8.8.16 [Kr]4d ⁷ 5s ¹	45 Rh Rhodium 2.8.8.16 [Kr]4d ⁸ 5s ¹	46 Pd Palladium 2.8.8.16 [Kr]4d ¹⁰	47 Ag Silver 2.8.8.16 [Kr]4d ¹⁰ 5s ¹	48 Cd Cadmium 2.8.8.16 [Kr]4d ¹⁰ 5s ²	49 In Indium 2.8.8.16 [Kr]4d ¹⁰ 5s ² 5p ¹	50 Sn Tin 2.8.8.16 [Kr]4d ¹⁰ 5s ² 5p ²	51 Sb Antimony 2.8.8.16 [Kr]4d ¹⁰ 5s ² 5p ³	52 Te Tellurium 2.8.8.16 [Kr]4d ¹⁰ 5s ² 5p ⁴	53 I Iodine 2.8.8.16 [Kr]4d ¹⁰ 5s ² 5p ⁵	54 Xe Xenon 2.8.8.16 [Kr]4d ¹⁰ 5s ² 5p ⁶	55 Cs Cesium 2.8.8.16 [Xe]6s ¹	56 Ba Barium 2.8.8.16 [Xe]6s ²	57-71	72 Hf Hafnium 2.8.8.16 [Xe]4f ¹⁴ 5d ² 6s ²	73 Ta Tantalum 2.8.8.16 [Xe]4f ¹⁴ 5d ³ 6s ²	74 W Tungsten 2.8.8.16 [Xe]4f ¹⁴ 5d ⁴ 6s ²	75 Re Rhenium 2.8.8.16 [Xe]4f ¹⁴ 5d ⁵ 6s ²	76 Os Osmium 2.8.8.16 [Xe]4f ¹⁴ 5d ⁶ 6s ²	77 Ir Iridium 2.8.8.16 [Xe]4f ¹⁴ 5d ⁷ 6s ²	78 Pt Platinum 2.8.8.16 [Xe]4f ¹⁴ 5d ⁹ 6s ¹	79 Au Gold 2.8.8.16 [Xe]4f ¹⁴ 5d ¹⁰ 6s ¹	80 Hg Mercury 2.8.8.16 [Xe]4f ¹⁴ 5d ¹⁰ 6s ²	81 Tl Thallium 2.8.8.16 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹	82 Pb Lead 2.8.8.16 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ²	83 Bi Bismuth 2.8.8.16 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ³	84 Po Polonium 2.8.8.16 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴	85 At Astatine 2.8.8.16 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵	86 Rn Radon 2.8.8.16 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶
5	87 Fr Francium 2.8.8.16 [Rn]7s ¹	88 Ra Radium 2.8.8.16 [Rn]7s ²	89-103	104 [261] Rf Rutherfordium 2.8.8.16 [Rn]5f ¹⁴ 6d ² 7s ²	105 [262] Db Dubnium 2.8.8.16 [Rn]5f ¹⁴ 6d ³ 7s ²	106 [266] Sg Seaborgium 2.8.8.16 [Rn]5f ¹⁴ 6d ⁴ 7s ²	107 [264] Bh Bohrium 2.8.8.16 [Rn]5f ¹⁴ 6d ⁵ 7s ²	108 [269] Hs Hassium 2.8.8.16 [Rn]5f ¹⁴ 6d ⁶ 7s ²	109 [268] Mt Meitnerium 2.8.8.16 [Rn]5f ¹⁴ 6d ⁷ 7s ²	110 [269] Ds Darmstadtium 2.8.8.16 [Rn]5f ¹⁴ 6d ⁸ 7s ²	111 [272] Rg Roentgenium 2.8.8.16 [Rn]5f ¹⁴ 6d ⁹ 7s ²	112 [277] Cn Copernicium 2.8.8.16 [Rn]5f ¹⁴ 6d ¹⁰ 7s ²	113 unknown Uut Ununtrium 2.8.8.16 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ¹	114 [289] Fl Flerovium 2.8.8.16 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ²	115 unknown Uup Ununpentium 2.8.8.16 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ³	116 [298] Lv Livermorium 2.8.8.16 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁴	117 unknown Uus Ununseptium 2.8.8.16 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁵	118 unknown Uuo Ununoctium 2.8.8.16 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁶																		

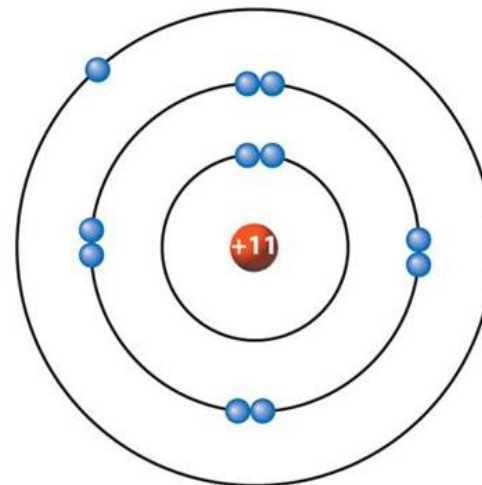
Lanthanide Series		57 La Lanthanum 2.8.8.16 [Xe]5d ¹ 6s ²	58 Ce Cerium 2.8.8.16 [Xe]4f ¹ 5d ¹ 6s ²	59 Pr Praseodymium 2.8.8.16 [Xe]4f ³ 6s ²	60 Nd Neodymium 2.8.8.16 [Xe]4f ⁴ 6s ²	61 Pm Promethium 2.8.8.16 [Xe]4f ⁵ 6s ²	62 Sm Samarium 2.8.8.16 [Xe]4f ⁶ 6s ²	63 Eu Europium 2.8.8.16 [Xe]4f ⁷ 6s ²	64 Gd Gadolinium 2.8.8.16 [Xe]4f ⁷ 5d ¹ 6s ²	65 Tb Terbium 2.8.8.16 [Xe]4f ⁹ 6s ²	66 Dy Dysprosium 2.8.8.16 [Xe]4f ¹⁰ 6s ²	67 Ho Holmium 2.8.8.16 [Xe]4f ¹¹ 6s ²	68 Er Erbium 2.8.8.16 [Xe]4f ¹² 6s ²	69 Tm Thulium 2.8.8.16 [Xe]4f ¹³ 6s ²	70 Yb Ytterbium 2.8.8.16 [Xe]4f ¹⁴ 6s ²	71 Lu Lutetium 2.8.8.16 [Xe]4f ¹⁴ 5d ¹ 6s ²
Actinide Series		89 Ac Actinium 2.8.8.16 [Rn]6d ¹ 7s ²	90 Th Thorium 2.8.8.16 [Rn]6d ² 7s ²	91 Pa Protactinium 2.8.8.16 [Rn]5f ² 6d ¹ 7s ²	92 U Uranium 2.8.8.16 [Rn]5f ³ 6d ¹ 7s ²	93 Np Neptunium 2.8.8.16 [Rn]5f ⁴ 6d ¹ 7s ²	94 Pu Plutonium 2.8.8.16 [Rn]5f ⁶ 7s ²	95 Am Americium 2.8.8.16 [Rn]5f ⁷ 7s ²	96 Cm Curium 2.8.8.16 [Rn]5f ⁸ 6d ¹ 7s ²	97 Bk Berkelium 2.8.8.16 [Rn]5f ⁹ 7s ²	98 Cf Californium 2.8.8.16 [Rn]5f ¹⁰ 7s ²	99 [254] Es Einsteinium 2.8.8.16 [Rn]5f ¹¹ 7s ²	100 Fm Fermium 2.8.8.16 [Rn]5f ¹² 7s ²	101 Md Mendelevium 2.8.8.16 [Rn]5f ¹³ 7s ²	102 No Nobelium 2.8.8.16 [Rn]5f ¹⁴ 7s ²	103 [262] Lr Lawrencium 2.8.8.16 [Rn]5f ¹⁴ 6d ¹ 7s ²

Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Metalloid	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide
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Octet Rule

- Most Main Group elements are electrically more comfortable with a full outer valence shell

Sodium atom

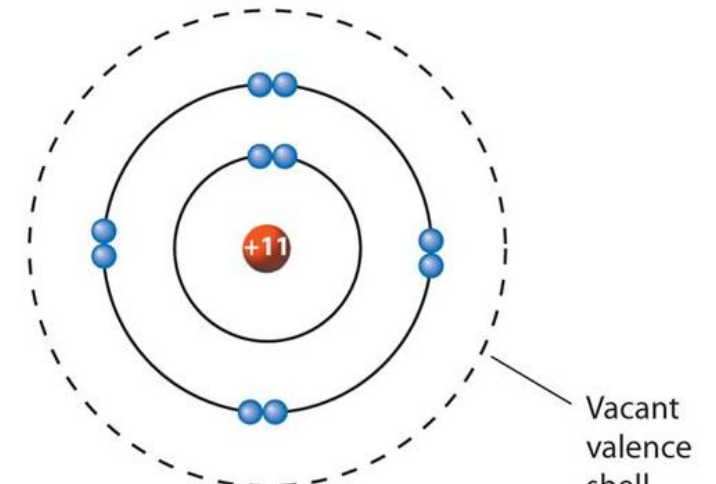


Na

11 protons
11 electrons

0 net charge

Sodium ion



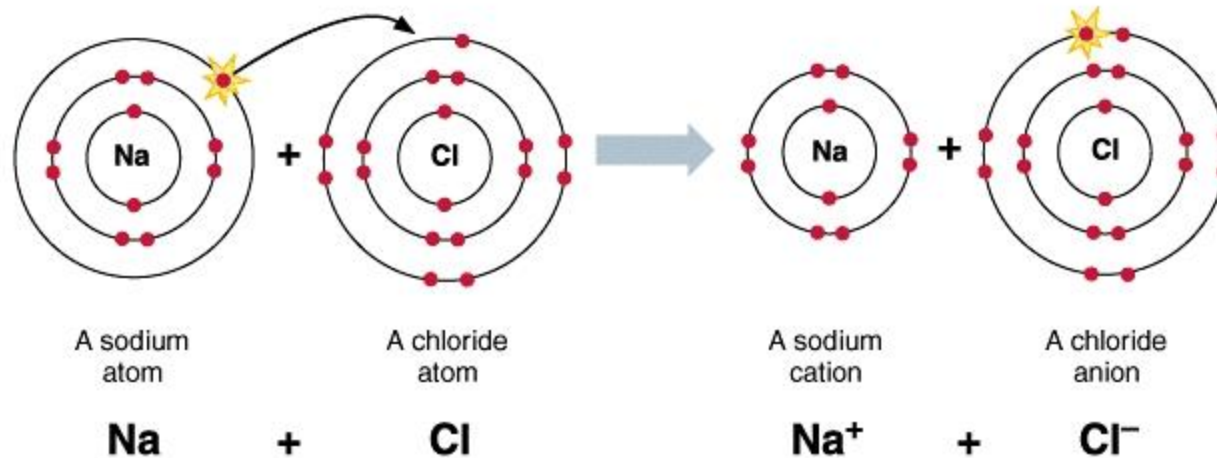
Na¹⁺ (positive ion)

11 protons
10 electrons

+1 net charge

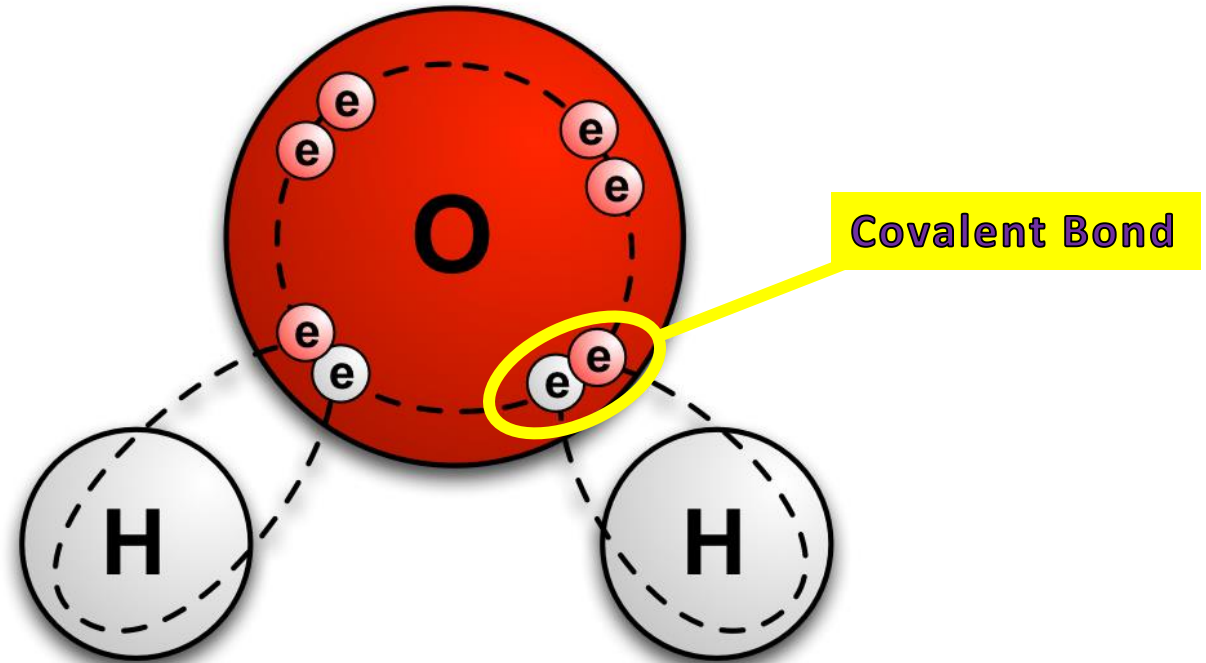
Formation of Salt (Ionic Bonding)

- Sodium will give away its outermost valence electron because it can fall back on a full inner shell. (Completes the octet rule)
- Chlorine will accept one more electron to complete its valence shell.



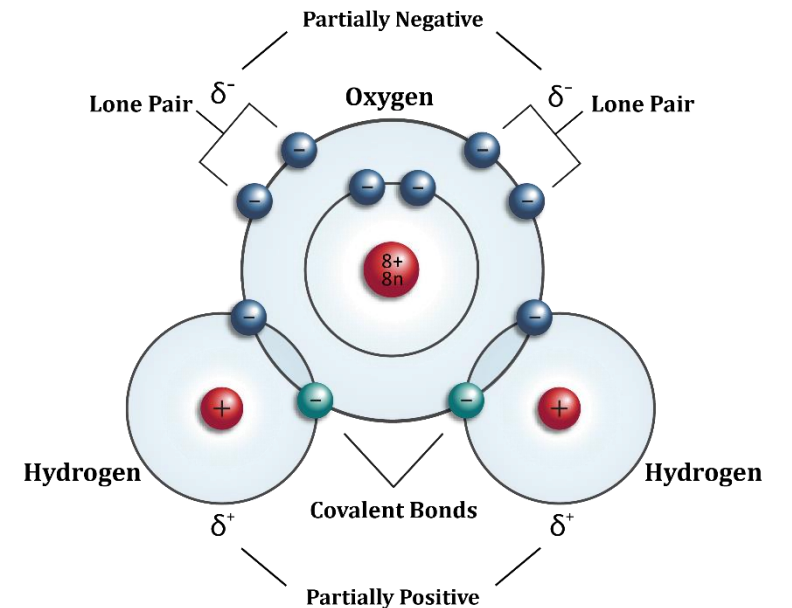
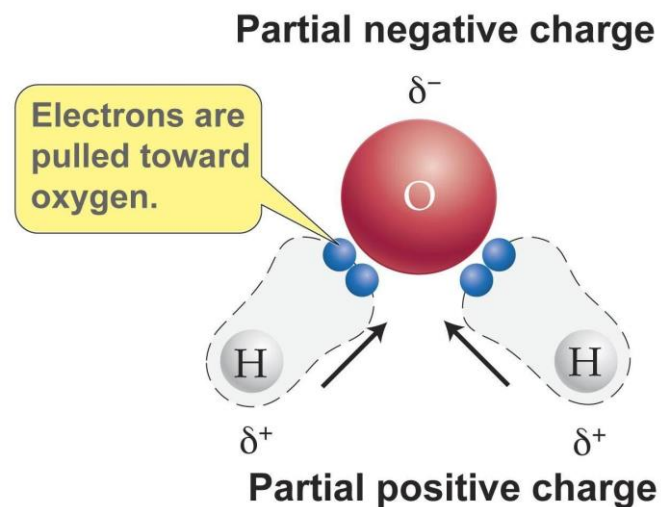
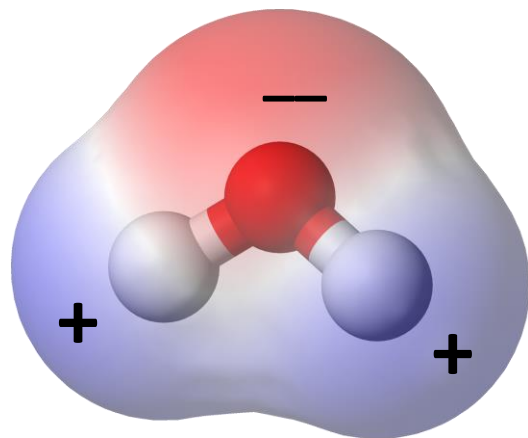
Covalent Bonding

- Covalent bonds form between two atoms sharing electrons.
- A single covalent bond is made of 2 shared electrons.
- Oxygen's electrons are **pink** in the picture.
- Hydrogen's electrons are **white** in the picture



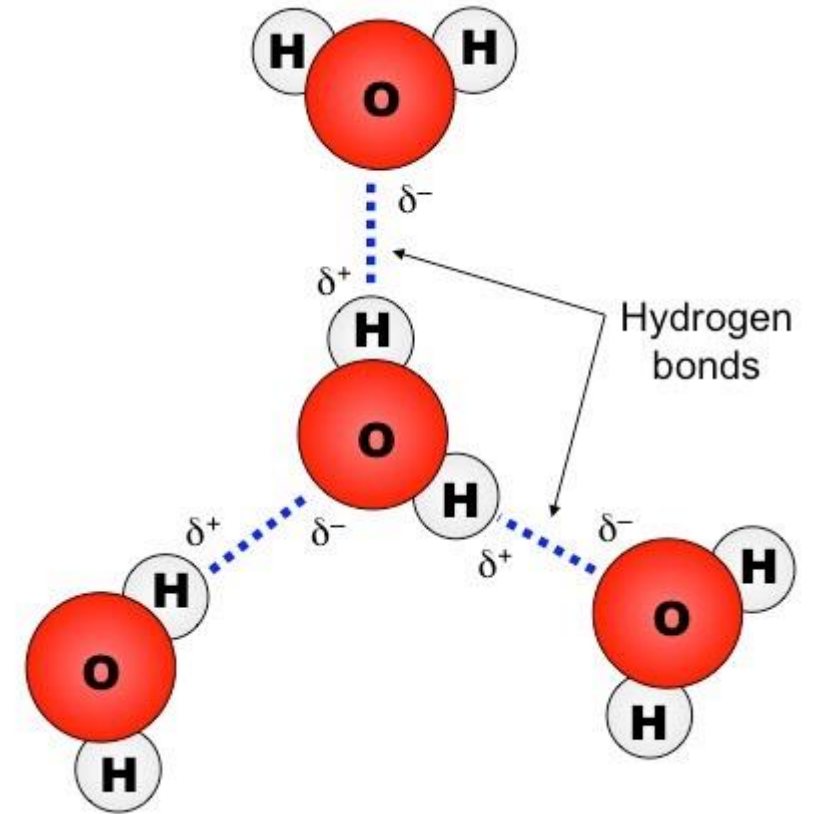
Water is a Polar Molecule

- The electrons in a water molecule spend more time around the Oxygen nucleus than the other two Hydrogen nuclei.
- That makes the oxygen region of a water molecule more negative, while the hydrogen regions are more positive.



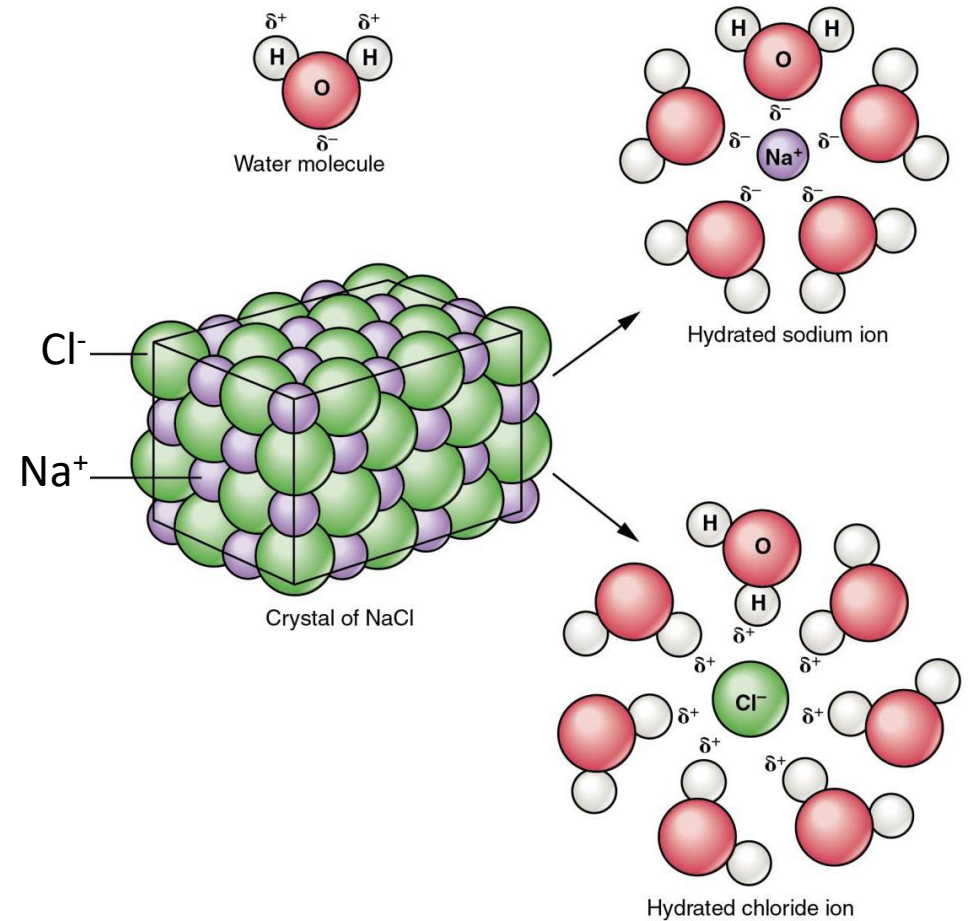
Cohesion

- Due to water's polar nature, the oppositely charged poles want to attract to other charged molecules (especially other waters)
- When a water molecule is attracted to other water molecules, it is called **Cohesion**.
- The bonds between the water's hydrogen and another negative molecule are called **Hydrogen Bonds** (*shown as dotted lines*)



Adhesion

- When a water molecule is attracted to something other than water, the process is called **Adhesion**.
- This is especially important when water acts as a Solvent to dissolve another substance (ex: salt, NaCl)



pH Scale

- The pH scale measures amount of free protons (H^+) that are released into solution.
- The more protons (H^+) that are in solution, the more acidic the solution is, the smaller the pH value.
- The fewer protons (H^+) that in in solution, the more basic the solution is, the higher the pH value.

pH Scale

- **Acids** have a pH less than 7
- Neutral (water) is 7
- **Bases** have a pH larger than 7

