Atomic Particles, Atoms, Isotopes, and Bonding Worksheet

Name	Symbol	Charge	Mass	Location
Electron	e-	-1	0	Energy shells surrounding nucleus
Proton	p+	+1	1 amu	Nucleus
Neutron	n	0	1 amu	Nucleus

Atomic Particles (amu = atomic mass unit)

Atomic mass = total mass of atom = # of protons + # of neutrons

Atomic number = # of protons = designation for element

Energy shells: electrons reside in energy shells surrounding the nucleus of an atom.

- Shell 1 maximum = 2 electrons (no more allowed)
- Shell 2, 3, 4, 5... maximum = 8 electrons (no more allowed)
- Therefore, the first two electrons go into shell 1, the next eight into shell 2, and so on.
- **Octet rule**: All atoms want to completely fill their outermost energy shell: 2 electrons maximum in the first shell and 8 maximum in all other shells.

Valence electrons = the number of electrons residing in the outermost unfilled energy shell **Bonding** = Atoms attempts to fill their outermost energy shell by removing, adding, or sharing electrons.

- **Ionic bonding** = Atom A gives up electrons to Atom B, so that both can achieve the octet rule. The result: two ions with equal and opposite charges that now attract each other.
- **Covalent bonding** = Atoms A and B both share one of their electrons with each other, thereby effectively gaining one. In such cases, the electrons orbit both nuclei, gluing them together most strongly.
- **Hydrogen bonding** = Hydrogen atoms bonded to oxygen (like in water) act as weak positive ions that can then weakly attract negative ions. This is how water dissolves ions so easily, by surrounding and attacking ionic bonds, pulling the positive and negative ions apart. Hydrogen bonds are weak bonds, and so it take a number of water molecules to pull apart one salt molecule, for example.
- **Isotopes** = atoms with same atomic number (same # protons), but different # of neutrons. Therefore, they are the same element, but with different masses.
- **Atomic weight** = the average atomic mass of a given sample of an element (averaging in all its naturally occurring isotopes).



Complete these diagrams with all the missing information



Page 2/6

















4 ATOMS Each: # p+ = 8 # n = 8 atomic # = 8 element = Oxygen atomic mass = 16 # valence ebefore bond: # e- shared with other? # e- gained from other? # valence eafter bond:



CENTER ATOM: # p+ = 14 # n = 14 atomic # = 14 element = Silicon atomic mass = 28 # valence ebefore bond: # e- shared with other? # e- gained from other? # valence eafter bond:

2 ATOMS Each: # p+ = 1 # n = 0 atomic # = 1 element = Hydrogen atomic mass = 1 # valence ebefore bond: # e- shared with other? # e- gained from other? # valence eafter bond:

Covalent Bonding -- H2O

CENTER ATOM: # p+ = 8 # n = 8 atomic # = 8 element = Oxygen atomic mass = 16 # valence ebefore bond: # e- shared with other? # e- gained from other? # valence eafter bond: