

**CHEM 35**  
**Introductory Chemistry**  
**Quiz #2**

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1. How do *isotopes* of a particular element differ in their sub-atomic composition (i.e., # of protons, neutrons, and electrons)?

Isotopes of a particular element have the same number of protons and electrons, but differ in the number of **neutrons** - hence, their atomic masses differ.

2. Briefly explain why ionic bonds are formed when metals and non-metals react and why covalent bonds are formed when non-metals react with each other. Please use the concepts of Ionization Energy (IE), Electron Affinity (EA), and/or Electronegativity (EN) in your answer.

Metals have lower IE's than non-metals, while non-metals have a greater EA than do metals. This means that metals prefer to give up an electron (becoming a cation) while non-metals would prefer to pickup electrons (becoming an anion). This is quantified with EN values which relate to the ability of an element to attract electrons when bonded to another element. Non-metals have much larger EN's than do metals, so when they bond, they attract much most of the electron density from the metal, making an ionic bond. When non-metals bond together, they have very similar EN's and so the electron density is more equally shared, forming a covalent bond.

3. Using Lewis dot diagrams and VSEPR theory, predict the shape of CO<sub>2</sub>. Is there a dipole moment associated with this molecule (assume that the electronegativities of C and O are different)? Explain

$$4 + 12 = 16 \text{ electrons, total}$$



$$4 \text{ double bonds} + 4 \text{ nonbonded pairs} = 16 \text{ electrons}$$

Although each C=O bond has a dipole moment, they are symmetrically opposed, so there is no **net** dipole moment for CO<sub>2</sub>.