Chapter 2 reading guide. Tro 3rd ed.

Read Sections 2.1-2.8 in Chapter 2. It’s all about atoms, the Periodic Table, and naming compounds.

**Section 2.1, Imaging atoms**

Read about how scientists can image atoms and molecules with STM. This instrumentation was the birth of the nanotechnology that you might have read about: tiny machines or devices made by moving single atoms.

How many naturally occurring elements are there?

**Section 2.2, Who were the first people to use the term ‘atom?’**

Why did Aristotle’s views of matter become the widely held belief? Is this how science should work?

**Section 2.3, What natural laws lead to modern atomic theory?**

The law of Conservation of Mass is a very important concept in chemistry. When you burn a gallon of gasoline (which weighs about 5.5 pounds), where does the mass go? (hint: look up combustion reactions)

The Law of Definite Proportions describes mass ratios in compounds. Is the mass ratio of carbon to oxygen always the same in different samples of sucrose (C\textsubscript{12}H\textsubscript{22}O\textsubscript{11})? Is the mass ratio of carbon to oxygen always the same in different samples of sweetened ice tea (sucrose + water)?

Being able to apply the definitions of mixtures and compounds is important for understanding how the Law of Definite Proportions explains mass ratios in compounds.

The Law of Multiple Proportions describes mass ratios in different compounds with the same elements. Example 2.2 is a good one because it shows the mass ratio of O in NO\textsubscript{2} to O in N\textsubscript{2}O.

Dalton’s Atomic Theory has 4 parts. They were absolutely correct as far as Dalton knew in 1806. However, is it acceptable to revise a theory once new data is discovered? We’ll see how Dalton’s theory was great in 1806, but doesn’t explain everything we know about today.

**Section 2.4, How was the electron discovered?**

This section contains some vital information for us, like the “properties of electrical charges” side note. Do positively charged particles attract or repel each other? What is the charge of the electron? But that’s about it. Skip most of the text in 2.4, unless you like history.

**Section 2.5, How was the structure of an atom discovered?**
Read this section; it’s pretty light reading and is interesting in terms of how matter is constructed, especially at the end. You don’t need to know names of scientists, or dates, or specific details of the experiments described in 2.4 or 2.5.

Section 2.6. What are atoms made of?

Very important section, read carefully.
1. Do protons have very much mass? (no need to memorize mass in g for protons)
2. What are the 3 subatomic particles?
3. What are the relative charges and masses (in amu) of the 3 subatomic particles? (no need to memorize mass in g or charge in Coulombs)
4. How many electrons (about) are needed to equal the mass of a proton? (hint, it’s the inverse of the mass in amu of an electron)
5. Are all protons the same, or do protons from one element differ from those of another element?
6. What subatomic particle defines the identity of an element?
7. Must all atoms of a given element be exactly the same? What subatomic particle (if any) can be different in neutral atoms of the same element?
8. What are isotopes?
9. What does the symbol Å stand for? If carbon atoms are about 2 Å in diameter, and a human hair is about 50 μm in diameter. How many atoms would this be?

Check out how Atomic Symbols are written. Is the information displayed, and how numbers of protons, neutrons, and electrons are determined for specific isotopes.

Example 2.3 is great. But, you should work end of chapter problems 51, 53, and 61 for a full experience.

The mass number in atomic symbols is usually for a specific isotope, and is always a whole number. That number is the #p + #n for a given atom.

Sometimes one will need to use the nearest whole number of the average mass of that element when writing an atomic symbol if the specific mass number isn’t given. The average mass for all of the atoms that exist on the surface of the Earth is what you see on the periodic table.

How does losing or gaining electrons change the charge of an atom?

Conceptual Connection 2.5 is good to look at.

Section 2.7. What’s so great about the periodic table?

How are the elements arranged on the periodic table? Is it by mass of each atom?

Be able to locate on the periodic table these classes of substances:
- Metals
- Nonmetals
- Main-group elements
d. Transition metals
e. Noble gases
f. Halogens

Do elements in vertical columns on the periodic table have similar or different chemical properties?

Which elements are usually cations when they form compounds? Which are anions when they form compounds?

Figure 2.14 is very helpful for determining the charges of some elements when they form compounds.

**Section 2.8, What is the average mass of an element?**

Why aren’t the masses on the periodic table whole numbers, and not fractions?
How are atomic masses weighted?

Example 2.5 shows a sample calculation for atomic mass based on natural abundances.

Figure 2.16 shows a diagram of a mass spectrometer, which is used to determine the relative masses of specific atoms. The rest of the section goes on to describe how the atomic mass of silver is determined, with abundances (percentages) and the atomic mass, in amu.

**Section 2.9 Atomic masses**

This is probably the most fundamental section of the book, and converting from mass to moles or from moles to mass will become very easy in a week or two.

You must memorize Avogadro’s number to 4 significant figures.

Avogadro’s number can be used to calculate the number of any actual thing from its value in moles. Things could be atoms, molecules, ions, electrons, photons, or pretty much anything small.

Example 2.6 shows how to convert between number of moles and numbers of particles. Note how the Examples 2.7 and 2.8 are useful also. Example 2.8 has a video link in the MC study area.

Skip example 2.9, as it’s got some geometry about spheres that we don’t need to worry about.

Conceptual connections 2.7 and 2.8 are good to ponder. The answers to these are at the very end of each chapter.

If you haven’t noticed, the self-assessment quizzes at the end of the chapters are very useful reviews of the material.