

1. Fill out the chart! Do not use the noble gas abbreviation.

Atom	# of e- in the atom	electron configuration of the atom	nearest noble gas	# e- lost / gained in forming the ion	Symbol of ion that forms	electron configuration of the ion that forms
Mg		$1s^2 2s^2 2p^6 3s^2$				
O						
K						
Cl		$1s^2 2s^2 2p^6 3s^2 3p^5$				
N		$1s^2 2s^2 2p^3$				
Al						
Sc		$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$				
S		$1s^2 2s^2 2p^6 3s^2 3p^4$				

2. Valence electrons are the electrons in the outermost shell (n-level) of the atom.

- Underline the valence electrons in the electron configurations for each ATOM in the above chart, and then write the number of valence electrons it has next to the configuration.
- All of the ions above have the same number of valence electrons – how many do they have? _____

3. Which of these ions have a noble gas configuration? Cross out the ones that do NOT have a noble gas configuration. For the ones that DO have one, write the symbol of the noble gas it matches.

Mg^{+2} Fe^{+3} Cu^{+2} As^{-3} As^{+5} Cr^{+6} S^{-2}

 Ag^{+1} Te^{-2} K^{+1} Cr^{+3} La^{+3} Eu^{+3}

4. How many electrons are in a fluorine atom? _____ How many electrons are in a fluoride ion? _____
 Write the symbol (including the charge) for five ions that have the same number of electrons as a fluoride ion.

5. Write the symbol (including the charge) for three ions with the same number of electrons as Krypton.

(Include positive and negative ions) _____

IA

VIIA

Hydrogen																	Helium
	IIA																
Lithium	Beryllium											Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon
Sodium	Magnesium											Aluminum	Silicon	Phosphorus	Sulfur	Chlorine	Argon
Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton
Rubidium	Strontium	Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Xenon
Cesium	Barium	Lanthanum	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Polonium	Astatine	Radon
Francium	Radium	Lanthanum	Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Mtnerium	Ununnilium	Ununnilium	Ununnilium						

Darmstadtium (Ds) Roentgenium (Rg)

Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium
57	58												70
Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium
89	90												102

1.a. Family = _____ = _____

b. Period = _____

c. If elements are in the same family, they'll tend to react similarly (they'll form the same ion charges, they'll share electrons similarly, etc.) WHY?

2a. Label the alkali metals on the periodic table, above.

How many valence electrons does each alkali metal have? _____

When alkali metals form ions, what charge of ion do they typically form? _____

b. Label the alkali earth metals on the periodic table, above.

How many valence electrons does each alkali earth metal have? _____

When alkali earth metals form ions, what charge of ion do they typically form? _____

c. Label the halogens on the periodic table, above.

How many valence electrons does each halogen have? _____

When halogens form ions, what charge of ion do they typically form? _____

d. Label the noble gases on the periodic table, above.

All noble gases except helium have _____ valence electrons.

The noble gases are also known as the _____ gases.

e. Label the Lanthanides and the Actinides on the periodic table, above.

f. Label the transition metals and inner transition metals on the periodic table, above.

Most transition and inner transition metals have _____ valence electrons.

g. Label the representative elements on the periodic table, above.

h. How many valence electrons do B/Al/Ga/etc have? _____

How many valence electrons do C/Si/Ge/etc have? _____

How many valence electrons do N/P/As/etc have? _____ (these elements are called "pnictogens")

How many valence electrons do O/S/Se/etc have? _____ (these elements are called the "chalcogens")

3. Consider the elements Sulfur and calcium.

Which element is in the same period as Selenium? _____

Which element is in the same family as selenium? _____

Which element has the same number of valence electrons as selenium? _____

Which element tends to lose two electrons when it forms an ion? _____

Which element can bond either ionically or covalently, depending on what it bonds with? _____

4. (for each question in #4, give the column number, for example "IVA")

Which periodic table group has elements with 3 valence electrons? _____

Which group has an electron configuration ending in p^3 ? _____

Which group has 4 valence electrons? _____

Which group has atoms that tend to gain 2 electrons when forming an ion? _____

Which group has an electron configuration ending in p^5 ? _____

Which group has atoms that tend to lose 1 electron when forming an ion? _____

List two elements that have an electron configuration ending in d^5 _____

List two elements that have an electron configuration ending in f^7 _____

5. **Fluorescence** occurs when an atom absorbs one photon, and then immediately emits this energy as two or more smaller photons. For example, quinine (found in tonic water), could absorb a photon of ultraviolet light, and then emit one blue photon plus one infrared photon.

a. Draw a picture showing the process of fluorescence in an atom or molecule.

b. Suppose that a quinine molecule absorbs an ultraviolet photon with an energy 5.68×10^{-19} J and a wavelength of 350. nm. Use these values to fill in the first line of the chart below.

c. The quinine will then emit (release) two photons, which we will call "emitted photon #1" and "emitted photon #2" !! Emitted photon #1 has a wavelength of 450. nm, which corresponds to a photon energy of 4.42×10^{-19} Joules. Use these values to fill in the second line of the chart.

	Energy	Wavelength	part of EM spectrum (see WS 4.0 for the chart)
Incoming (absorbed) photon:	_____	_____	_____
Emitted photon #1:	_____	_____	_____
Emitted photon #2:	_____	_____	_____

d. Calculate the energy of "Emitted photon #2."

e. Calculate the wavelength of “Emitted photon #2” in nanometers, and fill in the rest of the chart on page 2.

6. The mineral “fluorite” or “fluorospar” can fluoresce. (The word *fluorescence* is derived from this mineral’s name!) This mineral can be several different colors (most commonly, purple, green, blue, yellow, or colorless), depending on the impurities present.

a. The chemical name of “fluorite” is **calcium fluoride**. What is the formula of this compound? _____

Suppose that a sample of fluorite absorbs ultraviolet light with a wavelength of 310. nanometers, and then emits two photons with smaller energy.

b. Determine the photon energy of the ultraviolet light.

c. Suppose that one of the emitted photons is an infrared photon with a frequency of 3.88×10^{14} Hz. Calculate the energy of this photon.

d. Based on the energy of the absorbed photon (in part b) and the first emitted photon (in part c), calculate the energy of the other emitted photon.

e. The photon emitted (in d) has a wavelength of 517 nm. In what part of the spectrum is this photon? _____

7. In **phosphorescence**, there is a delay between the absorption and emission of the photon(s). The excited electrons can occupy a “meta-stable” state for up to several hours, depending on the substance, before they “fall” back down to the ground state. What’s a possible use for phosphorescence? _____

8. “Fluorescent Lights” contain the element _____, which emits visible and ultraviolet light (and infrared) when excited by a voltage. The “phosphors” in the paint on the tube undergo fluorescence; they absorb the uv from the element _____ and then emit smaller energy photons, many of which are in the visible spectrum. What is the main advantage that fluorescent light bulbs have over incandescent light bulbs? (hint: environment!)
