WS 4.6 Ion Formation! Name:_____p._____

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.

a. 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.

b. 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}

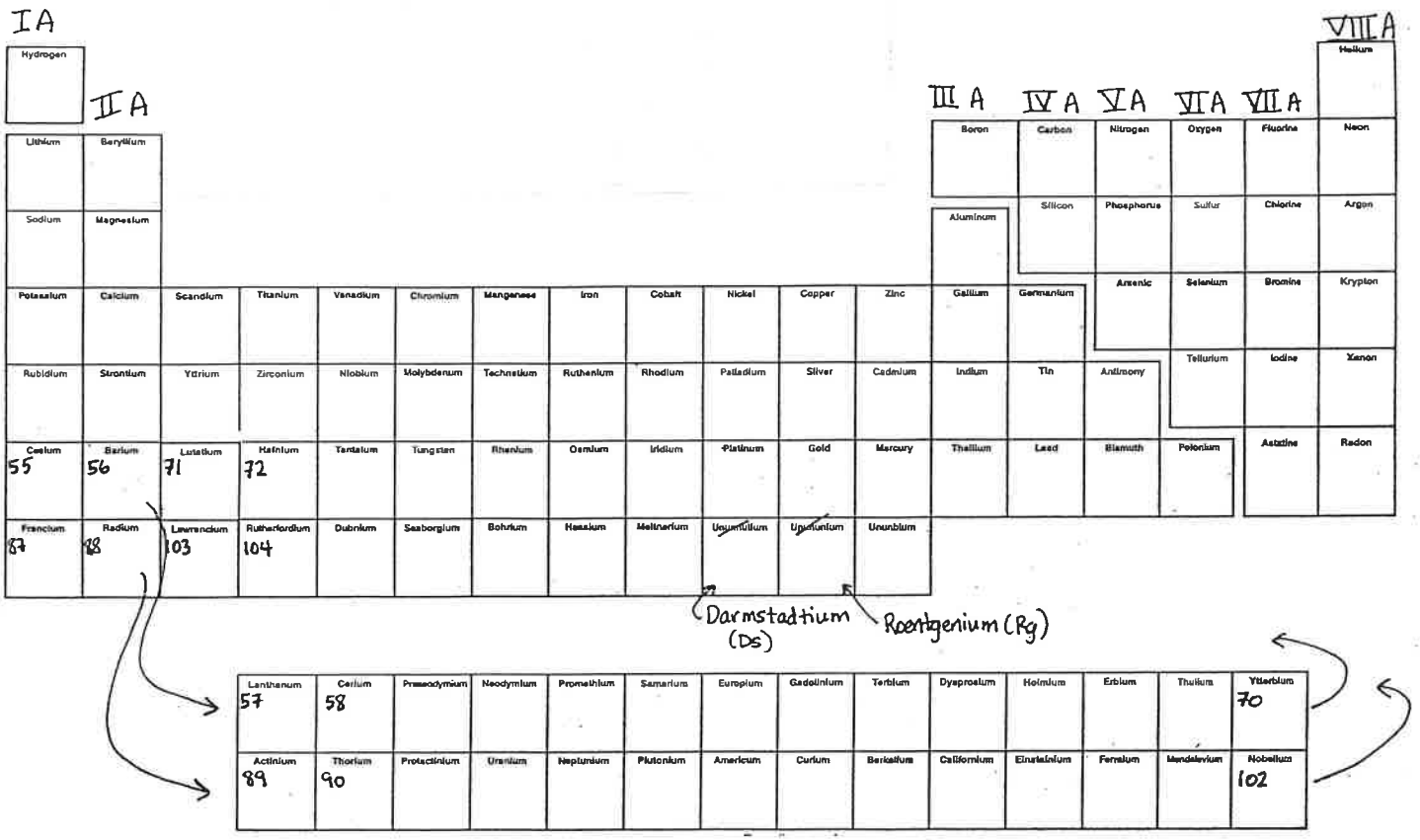
Ag^{+1} Te^{-2} K^{+1} Cr^{+3} La^{+3} Eu^{+3}

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) _____ _____ _____



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 <u>delay</u> 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!)

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