EZPZ Review: Unit 4 (Periodic Table)

This is called an "E-Z-P-Z" Review. This review only hits the basic and foundation of the unit.
The extended and more difficult questions were on your QUEST homework so look there! ☺
This is just to make sure you at least know the **basics**!

1. **Periodic Table origins: Mendeleev vs. Moseley**

   1) Who organized the periodic table by atomic number & properties? _Moseley_

      i. Atomic number is the number of _protons_

   2) Who organized the periodic table by atomic mass and properties? _Mendeleev_

   3) Which scientist was FIRST to put the periodic table in a table? _Mendeleev_

Element	Family name	# valence electrons	Ionic charge	Ionic vs. atomic radius	Properties	
Lithium	alkali metals	1	+1	smaller	soft lustrous conductor	HIGHLY reactive w/ H2O
Oxygen	n/a	6	-2	larger	n/a	
Fluorine	halogens	7	-1	larger	diatomic highly reactive	
Magnesium	alkaline earth metals	2	+2	smaller	stronger than alkali metals	reactive w/ hot water
Boron	n/a	3	+3	smaller	n/a	
Argon	noble gases	8	Ø	n/a	INERT	

2. **Identify the vocabulary term.**
   (atomic radius, ionization energy, electronegativity, effective nuclear charge/Z_{eff}, electron shielding)

   ionization energy (IE) : how much energy it takes to remove an electron (from valence level)

   atomic radius (AR) : the size of an atom

   electron shielding : Inner (core) electrons block part of the nuclear pull on electrons

   electronegativity : how strongly an atom attracts a valence electron

   effective nuclear charge : how strongly the nucleus attracts (pulls on) electrons
   _(Z_{eff})_

3. Coulomb's Law
   a) What type of energy is considered between:

   ➤ Positive and positive charge **repulsive**

   ➤ Positive and negative charge **attractive**

   ➤ Negative and negative charge **repulsive**

   b) What is the relationship between charge and energy?

   direct $(\uparrow Q, \uparrow E)$

   c) What is the relationship between distance (r) and energy?

   inverse $(\uparrow r, \downarrow E)$

   $$E \propto \frac{Q_1 Q_2}{r}$$

4. What is the difference between an atom and an ion?

   atom: $\#p^+ = \#e^-$

   ion: $\#p^+ \neq \#e^-$

5. Ionic Radius

Circle the one which is LARGER	Explain: why is that one larger?
(Mg) or Mg^{2+}	Mg has 3 energy levels, Mg^{2+} has 2 energy levels
O^{2-} or (N^{3-})	isoelectronic! but N^{3-} has fewer protons, so less attraction

Circle the one which is SMALLER	Explain: why is that one smaller?
(Cl) or Cl^-	Cl has $17p^+/17e^-$, but Cl^- has $17p^+/18e^-$ ↳ less repulsion & greater attraction
Li^+ or (Be^{2+})	isoelectronic! but Be^{2+} has more electrons, so more attraction

6. On each periodic table, draw one horizontal and one vertical arrow pointing in the direction in which the trend **increases**.

1. Ionization Energy Trend	2. Atomic Radius Trend	3. Electronegativity Trend
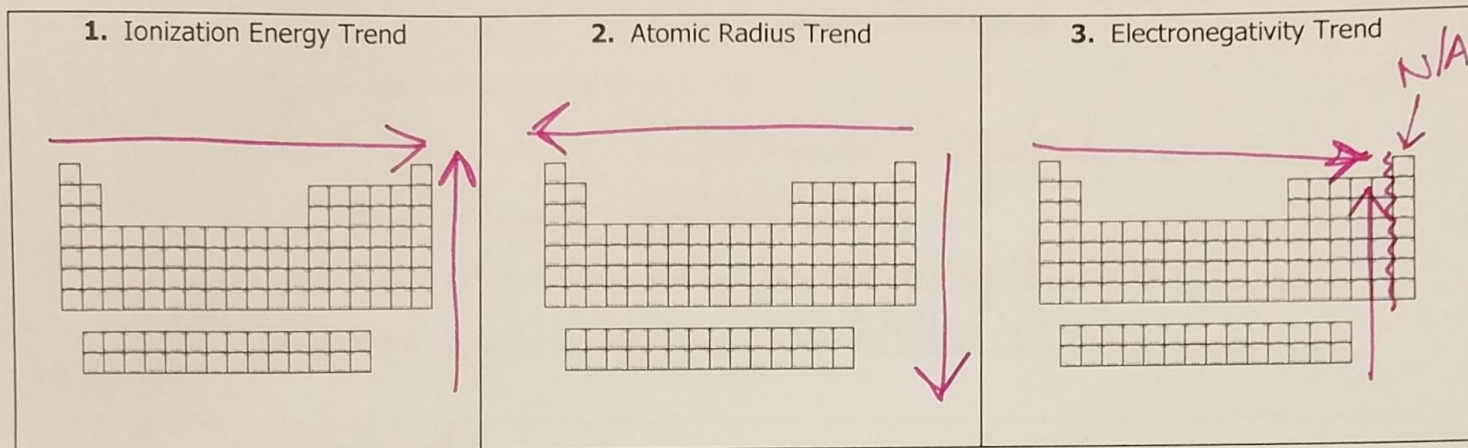
7. Explaining Trends

   a) Which has the **smallest** atomic radius: bromine vs calcium?
   $n=4$ $n=4$

   Br —same # energy levels (4), but Br has higher Zeff, which draws in valence electrons more tightly, decreasing AR

   b) Which has the **largest** electronegativity: gallium vs boron?
   $n=4$ $n=2$

   B —valence electrons in $n=2$ vs $n=4$, which decreases distance from the nucleus, increasing attraction in the valence e⁻

   c) Which of the following has the **smallest** ionization energy: sulfur vs tellurium?
   $n=3$ $n=5$

   Te —valence e⁻ in higher energy level ($n=5$ vs $n=3$), which increases distance to the nucleus & electron shielding, which decreases attraction, making electrons easier to steal

   d) In terms of atomic structure, explain why the first ionization energy of selenium is less than that of arsenic.

   Same number of energy levels, BUT paired electron repulsion in the 4p orbitals of Se decrease attraction to the nucleus so that it requires less energy to steal an electron

   e) In terms of atomic structure, explain why the atomic radius of lithium is less than that of potassium.

   Lithium has fewer energy levels than potassium (2 vs 4), so its valence electrons are closer to the nucleus, decreasing radius

   f) Which has a higher first ionization energy: magnesium or aluminum? Justify your answer.

   Although both elements have valence e⁻ in $n=3$, Al has a lower ionization energy because its p e⁻ does not penetrate the nucleus as well as the s orbital of Mg, so the electron in Al requires less energy to remove.

   g) Explain why strontium has a lower electronegativity than iodine.

   Sr & I both have valence e⁻ in $n=5$, but I has a stronger Zeff, which means that electrons are more attracted to the nucleus.

exception!

exception!