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Module 3: Elements and the Periodic Table

Directions

Click on the following website: www.ptable.com
You will interact with this periodic table to find the answers to the questions below.

Part 1; Atomic Numbers and Atomic Masses
Complete the following table, by finding the atomic numbers and atomic masses for each element:

Symbol	P	S	Cl	Ar	K	Ca
Atomic number	15	16	17	18	19	20
Atomic Mass	30.974	32.06	35.45	39.948	39.098	40.078

a. Using the data in the table above, is the periodic table organized by increasing atomic mass? Explain. NO. Potassium has a larger atomic mass than Argon

b. What property is the periodic table organized by?
Atomic Number

Part 2: Groups and Periods:
Continue to work in this site: www.ptable.com
Make sure the "Wikipedia" tab is selected in order to answer the following questions:

	Write your answers here:
1. The vertical columns on the periodic table are called *groups*, how many groups are there on the periodic table?	18
2. The horizontal rows on the periodic table are called *periods*, how many periods are there on the periodic table?	7
3. Which element is located in group 10 and period 4	Nickel
4. Which element is located in group 15 and period 5	Antimony
5. Which element is located in group 2 and period 2	Beryllium
6. Which element is located in group 18 and period 6	Radon
7. Which element is located in group 1 and period 7	Francium
8. Are most of the elements on the periodic table classified as a metal or a non-metal?	Metal
9. Are the non-metal elements located on the left or right side of the periodic table? Is there any exception?	Right, except Hydrogen.

Part 3: Families

Elements can also be classified by *family*, use the color coding at the top of the page to help identify the family names and their element members.

	Write your answers here:
1. How many elements belong to the Alkali Metal family? List the member elements by their symbol.	Six Li, Na, K, Rb, Cs, Fr
2. Click on the group number for the Alkali Metals family at the top of the table. Answer the following about the Alkali metals:	
a. What are 3 similar properties of these elements?	• High melting points • High boiling points • very high electrical and thermal conductivity
b. Where are these found naturally?	They aren't found naturally due to being unstable
c. What is a common substance that alkali metals react vigorously with?	water
3. What type of element does the bright green color indicate? List the element symbols for the elements that are designated with bright green:	Reactive Nonmetals C, N, O, F, P, S, Cl, Se, Br, I
4. Click on the group number for the Halogen family at the top of the table. Answer the following about the Halogen elements:	
a. How many elements belong to the Halogen family? List the member elements by their symbol.	Six F, Cl, Br, I, At, Ts
b. What does the name "halogen" mean?	Salt former (when they react with metals, they produce salts)
c. What type of molecule is formed when a halogen combines with hydrogen?	Acids
5. Tungsten (W), Copper (Cu), and Iron (Fe) all belong to the same family, whose members are generally used as conductors of electricity. What family is this?	Transition Metals

Part 4; Atomic Radius Exploration

	Write your answers here:
1. In your own words, define the term "radius."	Half of the diameter across a sphere or the distance from the surface to the center.
2. Let's assume an atom is shaped like a sphere, what subatomic particles (protons, neutrons or electrons) would be found in the center? What subatomic particles would be found around the perimeter?	→ Protons and Neutrons → Electrons
3. Keeping in mind your answers to questions 1 & 2, in your own words describe the meaning of "atomic radius"	The distance from the outer edge of the electron cloud to the nucleus

Directions
Interact with the periodic table in the website, www.ptable.com , to find the answers to the questions below.

- Click the "Properties" tab at the top of the page.
- Next select "Radius" from the properties listed in the top center of the screen.
- Finally make sure "Calculated radius" is selected from the options on the right.

4. Complete the following data table:

Group 1 element	Calculated Radius Value (pm)
H	53
Li	167
Na	190
K	243
Rb	265
Cs	298

5. What trend in the data do you observe as you move from the top of the periodic table to the bottom within this group?	The atomic radius increases.
6. Does this periodic trend apply to any other	

group? Briefly investigate the atomic radii values in another group to support your answer.	The same trend occurs in general for all groups. Group 13 goes 187 → 118 → 136 → 156 → ...
7. What ideas do you have about *the factors that actually contribute* to the atomic radius trend within a group? (Revisit your background questions to guide you).	As elements go down the periodic table, they gain more protons. Additional protons require additional electrons to balance the charge, resulting in a larger electron cloud.

8. Complete the following data table:

Period 2 element	Li	Be	B	C	N	O	F	Ne
Atomic Radius Value (pm)	167	112	87	67	56	48	42	38

9. What trend in the data do you observe as you move from the left of the periodic table to the right within this period?	The atomic radius decreases.
10. Does this periodic trend apply to any other period? Briefly investigate the atomic radii values in another period to support your answer.	The same trend generally occurs for all other periods as well.
11. What ideas do you have about *the factors that actually contribute* to the atomic radius trend within a period? (Think about subatomic particles)	As you go further right, although the number of protons increases, the number of orbitals and sublevels increase without increasing the number of electron levels. (The highest radius comes from high levels of low sublevels (orbitals.)
12. Hide the atomic radius values from yourself. Based on the trends you discovered, make a prediction, and place the following elements in order of increasing atomic radius (smallest to largest): Si, Ca, C, F, Cs	F, C, Si, Ca, Cs
13. Check values on www.ptable.com Was your prediction from question #12 correct?	42 → 67 → 111 → 194 → 298 yes.

Read the following descriptions of two important factors that affect the atomic radius of an atom, then answer the following questions:

Electron Shielding Effect: This is due to inner electrons "shielding" the valence

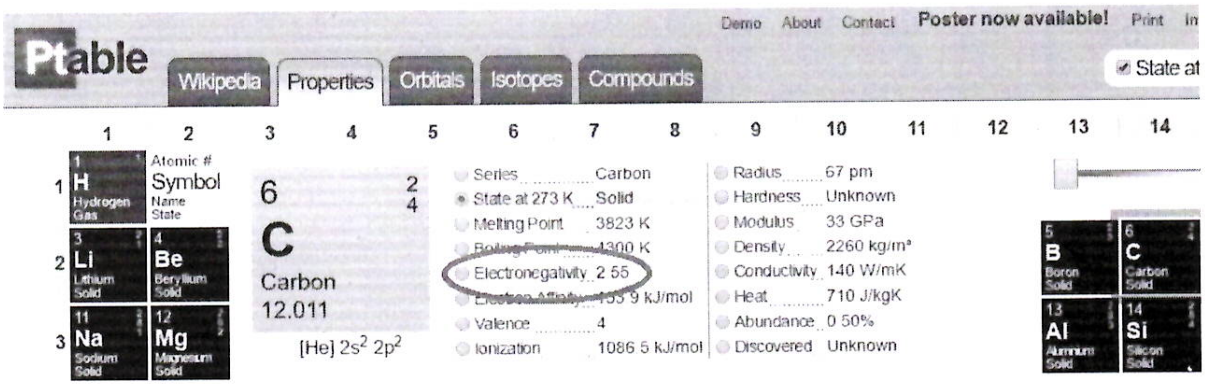
electrons from the positive pulling force of the nucleus. As an atom increases its number of electron shells, the shielding effect will increase in turn keeping the valence electrons distanced from the nucleus. ***Effective Nuclear Charge:*** This is due to the number of protons in an atom, the more protons the stronger the pulling force of the nucleus will be on the electrons in the atom.	
14. Revisit your answers for questions 4-7. Using the vocabulary terms given above make a statement about the atomic radius trend within a group on the periodic table. Use two specific elements as examples in your response.	For any given group, as the number of protons increases, the number of electron shells increases. Therefore, due to the Electron shielding effect, the atomic radius increases. For example, ~~Sodium to Rubidium~~ increases by two electron shells and 75 pm atomic radius.
15. Revisit your answers for questions 8-11. Using the vocabulary terms given above make a statement about the atomic radius trend within a period on the periodic table. Use two specific elements as examples in your response.	For any given period, as the number of protons increases without increasing the number of electron shells, the effective nuclear charge increasing causes the atom to effectively shrink. For example, Yttrium to Tin sees an increase of protons of 11 but a decrease of atomic radius of 67 due to no change in the number of shells.

Part 5; Electronegativity

Interact with the periodic table in the website, www.ptable.com , to find the answers to the questions below.

- Select the "Properties" tab at the top.

- Scroll over an element to see its electronegativity (see image below). Fill in the table below with the electronegativity values for the atoms provided. An example is provided for you.



1. Complete this table:

Element	Electronegativity
C	2.55
N	3.04
P	2.19
O	3.44
S	2.58
F	3.98
Cl	3.16
Br	2.96

1. Which atom is the most electronegative? How can you tell?	Flourine, as the electronegativity values increased going right and up, except for the Noble Gases.
2. In general, what happens to electronegativities as you move across the table to the right, (although there are a lot of exceptions).	It increases (except for noble gases)
3. In general, what happens to electronegativities as you move down the table (although there are a lot of exceptions).	It decreases.