

Key

TOPIC: GENERAL ARRANGEMENT OF THE PERIODIC TABLE

Part I: Vocab - Match the vocabulary term on the left with the definition on the right.

A. Periodic Law	1. <u>C</u> These elements are poor conductors and are not malleable, shiny nor ductile. These elements have a wide range of physical properties such as color, melting point and hardness.
B. Atomic Radius	2. <u>D</u> The energy required to remove the outermost electron from a neutral atom
C. Nonmetals	3. <u>G</u> A horizontal row on the periodic table. The row number is the same as the number of occupied energy levels.
D. Ionization Energy	4. <u>I</u> These elements are good conductors of heat and electricity. These elements are malleable, ductile, shiny and almost always solids at room temperature.
E. Groups	5. <u>H</u> This indicates an atom's ability to attract electrons in a chemical bond.
F. Valence Electrons	6. <u>B</u> This is the distance from the center of an atom's nucleus to the outermost electrons
G. Periods	7. <u>E</u> Elements with similar properties are arranged in vertical columns. These elements have the same number of valence electrons.
H. Electronegativity	8. <u>J</u> an atom's attraction for an electron to form a negative ion
I. Metals	9. <u>F</u> This is responsible for an atom's chemical properties and are located in the high occupied energy level.
J. Electron Affinity	10. <u>A</u> When elements are arranged in order of increasing atomic number, their physical and chemical properties show a periodic trend.

Part II: Practice- Identify if each of the following is a metal, nonmetal or metalloid.

a. Sodium metal
b. Carbon nonmetal

c. Boron metalloid
d. Gold metal

e. Aluminum metal
f. Fluorine nonmetal

Part III: Analysis and Application- Base your answer to 11 and 12 on the information below.

Densities of Group 14 Elements

Element	Density at STP (g/cm ³)
C	3.51
Si	2.33
Ge	2.33 - 7.31
Sn	7.31
Pb	11.35

11. Predict a value for the density of Ge. <u>between 2.33 - 7.31</u>
12. Identify one element of each type from group 14. Metal <u>Sn, Pb</u> Nonmetal <u>C,</u> Metalloid <u>Si, Ge</u>

13. Describe how an element's electron configuration is related to its location on the periodic table.

Period = # of occupied principal energy levels
Group = # of valence electrons.

TOPIC: GROUP CHEMISTRY

Part I: Properties of Families

Match the Group of elements with the appropriate family. Some of the groups may have multiple properties linked to them and some of the properties may be linked to multiple groups.

- | | | |
|--------------------------|-------------|---|
| A. Alkali Metals | 1, 2, 6, 10 | 1. Never exist in the free or uncombined state in nature |
| B. Alkaline Earth Metals | 1, 6, 10 | 2. Soft metals |
| C. Halogen | 7, 8, 11 | 3. Produced colored compounds and solutions |
| D. Nobel Gases | 4, 5, 9 | 4. Stable valence electron shell |
| E. Transition Metals | 3, 12 | 5. Inert (do not react) |
| | | 6. Highly reactive with water and air |
| | | 7. All diatomic elements |
| | | 8. Only group containing elements in all three states of matter |
| | | 9. All elements in the group are gases |
| | | 10. Reactive metals |
| | | 11. Reactive nonmetals |
| | | 12. Metals with low reactivity |

Part II: Throwback - Answer each of the following questions using your knowledge of chemistry.

- Which of the following represents an excited state electron configuration?
a. $1s^2 2s^2 2p^6 3s^2 3p^4$
b. $1s^2 2s^2 2p^6 3s^2$
c. $1s^2 2s^2 2p^6 3s^2 3p^4 4s^2 3d^5$
d. $1s^2 2s^2 2p^5 3s^2 3p^4 4s^2 3d^6$
- Which of the following best describes what happens when an electron transitions from the third energy level to the second energy level?
a. The electron absorbs energy in the form of heat.
b. The nucleus absorbs energy in the form of heat.
c. The nucleus releases energy in the form of light.
d. The electron releases energy in the form of light.

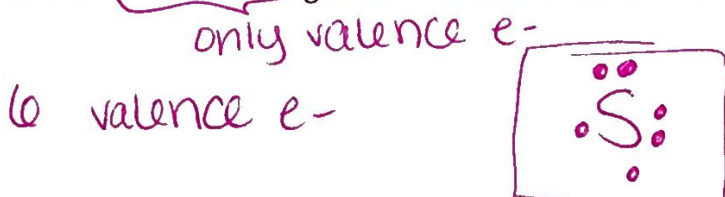
3. Construct an orbital fill diagram for a neutral atom of S-32.



4. How many unpaired electrons are in an atom of S-32?

2 unpaired = only 1 arrow in box

5. Construct a Lewis Dot diagram for a neutral atom of S-32.



TOPIC: PERIODIC TRENDS

1. For each pair of elements, circle the element with the larger atomic radius. Briefly explain the reasoning behind your choice in terms of nuclear charge and shielding effect.

- a. Mg or Ca Ca has 1 more principal energy level than Mg
- b. N or O same shielding, but O's nuclear charge is greater, hugging in e- tighter & decreasing radius
- c. O or O²⁻ Anion, so more e- & the repulsions cause them to spread out
- d. K or K⁺ K has 1 more principal energy level than K⁺.

2. For each pair of elements, circle the element with the higher first ionization energy. Briefly explain the reasoning behind your choice in terms of nuclear charge and shielding effect.

- a. F or Cl F has less shielding than Cl, so more attraction between nucleus + e-, making it more difficult to remove an e-.
- b. Al or Si same shielding, but Si has a greater nuclear charge, so more attraction b/w nucleus + e-

3. Despite boron being further down period 2 than beryllium, boron has a lower first ionization energy. Explain why in terms of electron configuration.

Boron's e- config is 1s²2s²2p¹ and Beryllium's is 1s²2s². Beryllium has a full 2s sublevel, so really doesn't want to lose e-, so a high ionization energy. Beryllium only needs to lose 1 e- to become stable, so lower IE.

4. For each pair of elements, circle the element with the lower electronegativity. Briefly explain the reasoning behind your choice in terms of nuclear charge and shielding effect.

- a. Li or O same shielding, but Li has a weaker nuclear charge than O, so not as great an attraction for e-.
- b. Ba or Sr More shielding in Ba, so not as great of an attraction for electrons.

5. For each pair of elements, circle the element with the higher electron affinity. Briefly explain the reasoning behind your choice in terms of nuclear charge and shielding effect.

- a. Ca or Ga same shielding, but Ga has a higher nuclear charge, so greater attraction for e-.
- b. Be or N same shielding, but N has a higher nuclear charge, so greater attraction for e-.

6. Circle the elements from the choices below that would be expected to have the most similar properties.

Cl Ca S Mg Sr Sc

a. Why are these elements expected to have similar properties?

They are in the same group, so have the same # of valence e-.

Additional Practice

Period # = # of occupied PEL
Group # = # of valence e⁻

1. The periodic table position *and* the chemical properties of the elements arise from their # of valence e⁻ (group #)
 - A) atomic mass
 - B) neutron charge
 - C) nuclear radius
 - D) covalent radius
 - E) electron configuration**

2. Which pair of atoms is expected to show the greatest chemical similarities? - same group, same valence e⁻
 - A) H and He
 - B) K and Ca
 - C) Sr and Ba**
 - D) Na and Cl
 - E) O and F

3. Which period contains elements which are all gases at standard temperature and pressure?
 - A) 1** → H & He
 - B) 2
 - C) 3
 - D) 4
 - E) 5

4. Which element in Period 3 has only one "p" electron in its valence shell? 1s²2s²2p⁶3s¹3p¹
 - A) Al**
 - B) C
 - C) Ge
 - D) Mg
 - E) Na**

5. The decreased effect of the attraction of a nucleus for valence electrons due to the presence of intervening electrons is the
 - A) periodic force
 - B) gravitational attraction
 - C) shielding effect**
 - D) electromagnetic attraction
 - E) weak force

6. For each subsequent electron removed from an atom, the ionization energy required Successive ionization energies are always higher than the 1st IE
 - A) increases**
 - B) decreases
 - C) remains the same
 - D) increases, then decreases
 - E) decreases, then increases

7. The highest electron affinity would be expected for the element whose electron configuration is represented by
 - A) 1s²2s²2p¹ **B**
 - B) 1s²2s²2p⁵ **F****
 - C) 1s²2s²2p⁶ **Ne**
 - D) 1s²2s²2p⁶3s¹ **Na**
 - E) 1s²2s²2p⁶3s² **Mg**

8. The electronegativity of elements is generally greater for ↳ increases across a period
 - A) metals
 - B) nonmetals**
 - C) noble gases
 - D) precious metals
 - E) transition elements

9. In the Periodic Table, metallic characteristics decrease from

least metallic

most metallic

 - A) left to right and top to bottom
 - B) right to left and top to bottom
 - C) right to left and bottom to top
 - D) left to right and bottom to top**
 - E) top to bottom, only

10. The set of elements containing only nonmetals is ↳ right of staircase
 - A) Cl, F, I**
 - B) C, Cl, Li
 - C) Al, Ba, K
 - D) Br, Fe, Ne
 - E) Al, Sb, Po

11. Which is not a diatomic molecule under normal conditions?
 - A) neon** Noble gas
 - B) iodine
 - C) oxygen
 - D) fluorine
 - E) nitrogen

12. Chemical elements having both metallic and nonmetallic characteristics are called
 - A) atoms
 - B) bi-metals
 - C) metalloids** (on staircase)
 - D) semi-solids
 - E) semiconductors

13. Which compound forms a green aqueous solution?
 - A) RbCl
 - B) CaCl₂
 - C) NiCl₂** → Transition Metals
 - D) ZnCl₂

14. Which element requires the least amount of energy to remove the most loosely held electron from a gaseous atom in the ground state? ↳ ionization energy
 - A) bromine
 - B) calcium
 - C) sodium**
 - D) silver

15. Which element has atoms with the strongest attraction for electrons in a chemical bond? - electroneg.
 - A) chlorine
 - B) nitrogen
 - C) fluorine**
 - D) oxygen