

Periodic Table Study Guide

Directions: Please use this packet as practice and review. DO NOT try to answer these questions during presentations, take notes on your brochure instead. Complete this worksheet between presentations in class and at home as homework. I will give an extra credit stamp each day for completed sections. The entire worksheet will be due on the day outlined in your timeline.

Periodic Law/History of the Periodic Table

1. Label the following on the periodic table at the back of the packet: **period, series, group, family, and atomic number**. In addition, **number each period and family** correctly.
2. _____ A horizontal row of blocks on the periodic table is called a(n): (a) group, (b) period, (c) family, (d) octet.
3. _____ Mendeleev's table was called periodic because the properties of the elements: (a) showed no pattern, (b) occurred at repeating intervals called periods, (c) occurred at regular time intervals called periods, (d) were identical.
4. _____ The periodic law allows some properties of an element to be predicted based on its: (a) position in the periodic table, (b) number of isotopes, (c) symbol, (d) color.
5. _____ Moseley discovered that elements with similar properties occurred at regular intervals when the elements were arranged in order of increasing: (a) atomic mass, (b) density, (c) radioactivity, (d) atomic number.
6. Name an imaginary element with the atomic number of 202. _____. The following table may help you.

0- Nil	5- Pent
1- Un	6- Hex
2- Bi	7- Sept
3- Tri	8- Oct
4- Quad	9- Ein
7. What is the atomic number of Unnilquadium? _____
8. _____ The periodic law states that the physical and chemical properties of elements are periodic functions of their: (a) masses, (b) atomic numbers, (c) radii, (d) structures.
9. _____ All of the following follow the periodic law except: (a) valance electrons, (b) electron configurations, (c) chemical and physical properties, (d) atomic number, (e) symbols and names.
10. In the periodic table, the atomic masses of Te and I decrease rather than increase, while their atomic numbers increase. This phenomenon happens to other neighboring elements in six other places on the periodic table. Name two of the sets of elements, more for bonus points.

Alkali/Alkaline Earth Metals

1. Color the alkali metals **orange**, and the alkaline earth metals **green** on the periodic at the back of the packet. Draw a key at the bottom of the page that identifies the meaning of each color. Continue expanding this key as you add to the table. Draw an arrow that shows increasing reactivity in the two families.

2. _____ In nature, alkali and alkaline earth metals occur as: (a) elements, (b) compounds, (c) complex ions, (d) gases.
3. _____ The group of soft, silvery active metals, all of which have one electron in an s orbital, is known as the: (a) alkaline earth metals, (b) transition metals, (c) alkali metals, (d) metalloids.
4. _____ In the alkaline earth group, atoms with the smallest radii: (a) are the most reactive, (b) have the largest volume, (c) are all gases, (d) are the least reactive.
5. _____ (True or false) Beryllium is more reactive than Lithium.
6. _____ (True or false) Lewis Structures of alkaline earth metals have two dots.
7. _____ As you travel down these families which of the following increases? (a) radii of atoms and ions, (b) 1st Ionization Energy (c) melting and boiling points, (d) electronegativity
8. Name the alkaline earth metal with the largest electron affinity value: _____ .

Transition Metals & Inner Transition Metals

1. On the periodic table worksheet, color the transition metals **purple** and the inner transition metals **pink**. Identify the lanthanide and actinide series by labeling them. Draw arrows to show the trends across periods and down families for electron affinity, ionization energy, atomic radii, and electronegativity, in all the transition metals.
2. _____ Which of the following is NOT a characteristic of the transition metals: (a) ductility, (b) malleability, (c) dull luster, (d) often form colored compounds.
3. _____ is the only transition metal that exists as a liquid at room temperature.
4. _____ Brass is an alloy made up of: (a) copper and nickel, (b) copper and zinc, (c) silver and iron, (d) silver and gold.
5. The trends for the transition metals do not always follow the same patterns as the main group elements because of the filling of the _____ sublevel. (Hint: recall electron configurations)
6. If the lanthanide series were part of the main periodic table, Cerium would be listed after what element?

7. _____ Which of the following best describes the actinides? (a) all are manmade (b) all are radioactive, (c) all are named after a scientist, (d) only four can be found on earth, the others are man made.
8. _____ Which of the following best describes the lanthanides? (a) all are manmade (b) all are radioactive, (c) all are named after a scientist, (d) only four can be found on earth, the others are man made.
9. The trends for the inner transition metals do not follow the same patterns as the main group elements because of the filling of the _____ sublevel. (Hint: recall electron configurations)

Boron, Carbon, Nitrogen, and Oxygen Families

1. On your periodic table worksheet, color the non-metals **blue**, the metalloids **yellow**, and the other, "heavy" metals **red**. Draw the "stair-step" line in black. Do not color the halogens and noble gases.
2. _____ The elements C, Si, Ge, Sn, and Pb are known as the: (a) the halogens, (b) the Noble Gases, (c) the carbon family, (d) the nitrogen family.

- _____ The boron, carbon, nitrogen, and oxygen families are all located in the upper right portion of the periodic table. From this you can tell that these families have valence electrons in which orbitals: (a) s, (b) p, (c) d, (d) f, (e) s and p (f) d and f.
- As you travel down the carbon family, the elements go from being vital for life to _____.
- Silicon and carbon form long chained compounds called _____.
- _____ Which of the following elements does not covalently bond with itself to form a diatomic molecule: (a) hydrogen, (b) boron, (c) nitrogen, (d) oxygen.
- Name the Group 15 element with the largest electronegativity: _____.
- _____ Which has the largest atomic radius, Al or In?

Halogens and Noble Gases

- On your periodic table worksheet, outline the noble gases in **orange** and color the halogens **red**. Draw and label a line that shows increasing reactivity in the halogen family.
- _____ All noble gases have completely filled: (a) s orbital, (b) p orbital, (c) d orbital, (d) f orbital, (e) s and p orbitals, (f) d and f orbitals.
- _____ is the noble gas with the most tendency to form bonds with other elements.
- _____ The most distinctive property of the halogens is that they are (a) metallic, (b) highly reactive, (c) radioactive, (d) metalloids.
- _____ The most distinctive property of the noble gases is that they are (a) metallic, (b) mostly inert, (c) radioactive, (d) metalloids.
- _____ (True or False) Halogen reactivity increases as you go down the family.
- The word halogen means _____ former because: (a) this was how they were first found, (b) it's what we eat, (c) that's the only reactions they undergo.
- _____ is the most reactive element on the periodic table.

Electron Affinity

- Draw and label arrows that indicate increasing electron affinity in groups and periods.
- _____ Electron affinity is: (a) the measure of the ability of an atom in a chemical compound to attract an electron. (b) the energy change that occurs when an electron is acquired by a neutral atom. (c) the energy required to remove an electron from a neutral atom (d) causes elements to glow when excited.
- It is the _____ (gain/loss) of valence electrons that produces anions
- When going down a column, it is the increase in _____ (nuclear charge/ energy levels) that causes electron affinity to decrease.
- List the following elements in order of increasing electron affinity F, O, C, Be: _____.
- List the halogens in order of increasing electron affinity: _____.
- Circle the element that is most likely to form an anion: **F or Ca**

Ionization Energy

1. Draw and label arrows to indicate increasing ionization energy in groups and periods.
2. _____ Ionization energy is: (a) the measure of the ability of an atom in a chemical compound to attract an electron. (b) the energy change that occurs when an electron is acquired by a neutral atom. (c) the energy required to remove an electron from a neutral atom (d) causes elements to glow when excited.
3. When going down a column, it is the increase in _____(nuclear charge/ energy levels) that causes electron affinity to decrease.
4. List the following elements in order of increasing ionization energy: Li, Ne, O, C _____
5. Arrange the alkali metals in order of decreasing ionization energy: _____
6. _____ For each successive electron removed from an atom, the ionization energy: (a) increases (b) decreases, (c) remains the same, (d) decreases down to noble gas configuration then increases dramatically, (e) shows no pattern.

Atomic and Ionic Radii

1. Draw and label arrows that indicate increasing atomic radii in groups and periods.
2. _____As you move across the periodic table from scandium through zinc, atomic radii: (a) generally increase, (b) generally decrease, (c) do not change, (d) vary unpredictably.
3. A positive ion is always _____(larger or smaller) than it's neutral atom.
4. A negative ion is always _____(larger or smaller) than it's neutral atom.
5. _____ the alkaline earth metal with the largest atomic radius.
6. Circle the element with the largest radius: Ga Se
7. Circle the element/ion with the largest radius: S S²⁻

Electronegativity

1. Draw and label arrows that indicate increasing electronegativity in the groups and periods on your periodic table.
2. _____ Electronegativity is: (a) the measure of the ability of an atom in a chemical compound to attract an electron. (b) the energy change that occurs when an electron is acquired by a neutral atom. (c) the energy required to remove an electron from a neutral atom (d) causes elements to glow when excited.
3. Using the periodic table, circle the element that is the most electronegative: C N O Br S
4. Electronegativity _____ (increases/decreases) as you move left to right across a period because (a) electrons are placed into the same energy level and the nucleus pulls on these electrons, (b) successive energy levels shield the nucleus from holding onto the valence electrons.
5. Electronegativity _____ (increases/decreases) as you move down a family because (a) successive energy levels shield the nucleus from holding onto the valence electrons, (b) electrons are placed into the same energy level and the nucleus pulls on these electrons,
6. _____ is the most electronegative element, while _____ is the least electronegative.

7. _____ The greater the electronegativity difference between two atoms bonded together, the greater the bond's percentage of (a) ionic character, (b) covalent character, (c) metallic character, (d) electron sharing.
8. Use the Pauling Scale of electronegativities to identify the following bonds as: **non-polar covalent, polar covalent, or ionic.**
- | | 100% | 50% | 5% | 0% |
|----------------------------|-------|-----|----------------|-------------------|
| % ionic character | | | | |
| Δ electronegativity | 3.3 | 1.7 | 0.3 | 0.0 |
| | ionic | | polar covalent | nonpolar covalent |
- a. carbon - phosphorus
- b. oxygen - hydrogen
- c. iodine - bromine
- d. hydrogen – fluorine
- e. calcium - sulfur

Covalent, Ionic, and Metallic Bonding

- The electrons involved in the formation of a chemical bond are called _____ .
- _____ A covalent bond consists of (a) a shared electron, (b) a shared electron pair, (c) two different ions, (d) an octet of electrons.
- _____ A covalent bond where the shared electrons are closer to one atom is called: (a) non-polar, (b) polar, (c) ionic, (d) dipolar
- _____ In metals, the valence electrons are considered to be : (a) attached to particular positive ions, (b) shared by all surrounding atoms, (c) immobile, (d) involved in covalent bond
- The fact that metals are malleable and ionic crystals are brittle is best explained in terms of their: (a) chemical bonds, (b) London forces, (c) heats of vaporization, (d) polarity
- Mobile electrons in the metallic bond are responsible for (a) luster, (b) thermal conductivity, (c) electrical conductivity, (d) all of these, (e) none of these
- _____ An ionic bond consists of: (a) a shared electron, (b) a shared electron pair, (c) electrical attraction between positive and negative ions, (d) interaction between two nuclei.
- _____ A metallic bond/alloy consist of the kernels of the atom (a) sharing electrons between two atoms, (b) surrounded by a sea of valence electrons, (c) exchanging electrons with other kernels.
- _____ In a crystal of an ionic compound, each cation is surrounded by a number of: (a) molecules, (b) other cations, (c) anions, (d) dipoles
- Use your periodic table to label the following pairs of bonding elements as forming covalent, ionic, or metallic bonds:
 - Nitrogen – Oxygen
 - Magnesium – Sulfur
 - Iron – Bromine
 - Copper – Zinc
 - Chlorine – Chlorine
 - Sodium – Chlorine

11. Draw the Lewis dot diagrams for the making of the following compounds:

- a. Water (H_2O)
- b. sodium chloride (NaCl)
- c. chlorine, the molecule (Cl_2)
- d. Magnesium chloride (MgCl_2)

Hydrogen Bonding

On your periodic table, **circle with black** the elements that will participate in hydrogen bonding when they are bonded to hydrogen.

1. _____ the forces of attraction between molecules in a molecular compound are (a) stronger than the attractive forces in ionic bonding, (b) weaker than the attractive forces in ionic bonding, (c) approximately equal to the attractive forces in ionic bonding, (d) equal to zero.
2. _____ Hydrogen bonding is responsible for which of the following (a) surface tension of water, (b) capillary action, (c) expansion of water upon freezing, (d) raise in boiling point, (e) structure of DNA, (f) all of these
3. Fill in the following table:

	Metallic	Ionic	Covalent	H-bonding
Components				
Overall charge				
Conductivity				
Melting/boiling points				
Hardness				
Malleable/ductile				
Luster				

Molecular Shapes and Polarity

What shape will the following compounds be? Draw each shape and show (draw- look in your book about the proper method of “showing” polarity) if the bonds are polar, or not, and if the overall molecule is polar, or not, and how you know.

Item	Lewis Diagram of Molecule	Drawing of Shape	Name of Shape	Bond(s) Polarity and Why	Molecule Polarity and Why
CH ₄					
H ₂ O					
PCl ₅					
CO ₂					
N ₂					