

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

Ms. Randall

General Chemistry

Unit 4 Periodic Trends: General Chemistry Review

## THE PERIODIC LAW

1. The **Periodic Law** states that when elements are arranged in order of increasing atomic number, repetitious trends can be seen. **Mendeleev's** periodic table was arranged in order of increasing atomic mass. He then arranged columns in order to have elements with similar properties align in columns. The **modern** table is arranged by atomic number.

a. What subatomic particle decides the order of the modern periodic table? \_\_\_\_\_

b. Explain how Mendeleev's table is only slightly different than the modern table. \_\_\_\_\_

\_\_\_\_\_

c. Define the term isotope and explain how it relates to the atomic mass of an element. \_\_\_\_\_

\_\_\_\_\_

d. How are the atomic mass and mass numbers of an element different? \_\_\_\_\_

\_\_\_\_\_

## METALS, NONMETALS, AND METALLOIDS

2. **Metals** are elements on the left side of the staircase on the periodic table. They have 1-2 valence electrons, which they tend to lose to form cations. Metals are **lustrous, malleable, ductile**, and good conductors of heat and electricity.

a. Define lustrous. \_\_\_\_\_

b. Define malleable. \_\_\_\_\_

c. Define ductile. \_\_\_\_\_

d. Circle the metal:            H                    P                    Cu                    S

3. **Nonmetals** are elements on the right side of the staircase on the periodic table. They have 4-8 valence electrons, which they tend to gain to form anions and fill their octet. Nonmetals are dull, brittle, and poor conductors of heat and electricity.

a. Circle the nonmetal:        C                    Mg                    Na                    Au

b. Why is hydrogen considered to be a nonmetal? \_\_\_\_\_

4. **Metalloids** are elements that touch the staircase on the periodic table. They have properties of both metals and nonmetals.

a. Most elements on the periodic table can be classified as metal, nonmetal, or metalloid?

b. Circle the metalloid: S Si Se Sr

c. Circle the element that is lustrous: Na N Rn Ne

d. Circle the element that is malleable: Mg C Ar H

e. Circle the element that is dull: S Sc Sr Sn

f. Circle the best conductor: C Cl Cu He

g. Circle the element that has properties of both metals and nonmetals: Ge Ga

## GROUPS AND PERIODS

5. **Periods** are the horizontal rows on the periodic table. Elements in the same period have the same number of electron levels in the Bohr diagram.

a. Draw Bohr diagrams of Na, Si, Li and C and show how you can tell which are in the same period.

b. How many energy levels will an atom in the second period have? \_\_\_\_\_ Third period? \_\_\_\_\_

6. **Groups** (or families) are the vertical columns on the periodic table. Elements in the same group have the same number of valence electrons and often have similar properties.

a. How many valence electrons do the following atoms have?

Na: \_\_\_\_ Mg: \_\_\_\_ Al: \_\_\_\_ Si: \_\_\_\_ P: \_\_\_\_ S: \_\_\_\_ Cl: \_\_\_\_

b. Which two have the same number of valence electrons? Ca S Mg

7. Group 1 elements are the **Alkali Metals**, which have 1 valence electron and are very reactive (explode in water). Group 2 elements are the **Alkaline Earth Metals**, which have 2 valence electrons and are still very reactive (not as much as alkali). Groups 3-12 are the **Transition Metals**, which form colored compounds and solutions. Group 17 elements are the **Halogens**, which have 7 valence electrons and are the most reactive nonmetals. Group 18 are the **Noble Gases**, which have 8 valence electrons and are not reactive.

a. Why are the noble gases not reactive? \_\_\_\_\_

b. Which element may be blue in solutions?	C	Cu	Ca	Cl
c. Which element is a halogen?	C	Cu	Ca	Cl
d. Which element is an alkaline earth metal?	C	Cu	Ca	Cl
e. Which element is a noble gas?	H	F	Cs	Rn
f. Which element is the most reactive metal?	H	F	Cs	Rn
g. Which element is the most reactive nonmetal?	H	F	Cs	Rn
h. Which element is not reactive?	H	F	Cs	Rn

### ATOMIC RADIUS

8. The **atomic radius** is the size of an atom. You can look up the atomic radius on Table S of the reference tables.

a. Record the atomic radius of: Li \_\_\_\_\_ Be \_\_\_\_\_ B \_\_\_\_\_ C \_\_\_\_\_  
 N \_\_\_\_\_ O \_\_\_\_\_ F \_\_\_\_\_ Ne \_\_\_\_\_

b. As you go across a period the atomic radius \_\_\_\_\_ because \_\_\_\_\_  
 \_\_\_\_\_

c. Record the atomic radius of: Na \_\_\_\_\_ Li \_\_\_\_\_ K \_\_\_\_\_ Rb \_\_\_\_\_ Cs \_\_\_\_\_

d. As you go down a group the atomic radius \_\_\_\_\_ because \_\_\_\_\_  
 \_\_\_\_\_

e. Which element is the largest? \_\_\_\_\_ The smallest? \_\_\_\_\_

### ELECTRONEGATIVITY

9. The **electronegativity** of an atom is its ability to gain an electron. You can look up the electronegativity on Table S of the reference tables.

a. Record the electronegativity of: Li \_\_\_\_\_ Be \_\_\_\_\_ B \_\_\_\_\_ C \_\_\_\_\_  
 N \_\_\_\_\_ O \_\_\_\_\_ F \_\_\_\_\_ Ne \_\_\_\_\_

b. As you go across a period the electronegativity \_\_\_\_\_ because \_\_\_\_\_  
 \_\_\_\_\_

- c. Record the electronegativity of: Na \_\_\_\_\_ Li \_\_\_\_\_ K \_\_\_\_\_ Rb \_\_\_\_\_ Cs \_\_\_\_\_
- d. As you go down a group the electronegativity \_\_\_\_\_ because \_\_\_\_\_
- 
- e. Why don't noble gases have electronegativity values? \_\_\_\_\_
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- f. Which element has the highest electronegativity? \_\_\_\_\_

### IONIZATION ENERGY

10. The last level contains **valence** electrons that can be lost or gained to form ions involved in bonding. **Cations** are positive ions that have lost electrons, therefore having more positive protons than negative electrons. **Anions** are negative ions that have gained electrons and then have fewer protons than electrons.

- a. How many valence electrons does Sodium have? \_\_\_\_\_
- b. How many valence electrons does fluorine have? \_\_\_\_\_
- c. If an atom has 8 protons and 10 electrons, what is the charge? \_\_\_\_\_ What type of ion is it? \_\_\_\_\_
- d. If an atom has 12 protons and 10 electrons, what is the charge? \_\_\_\_\_ What type of ion is it? \_\_\_\_\_

11. The **ionization energy** of an atom is how much energy is required to remove an electron from the valence. You can look up the ionization energies on Table S of the reference tables.

- a. Record the ionization energies of: Li \_\_\_\_\_ Be \_\_\_\_\_ B \_\_\_\_\_ C \_\_\_\_\_  
 N \_\_\_\_\_ O \_\_\_\_\_ F \_\_\_\_\_ Ne \_\_\_\_\_
- b. As you go across a period the ionization energies \_\_\_\_\_ because \_\_\_\_\_
- 
- c. Record the ionization energies of: Na \_\_\_\_\_ Li \_\_\_\_\_ K \_\_\_\_\_ Rb \_\_\_\_\_ Cs \_\_\_\_\_
- d. As you go down a group the ionization energies \_\_\_\_\_ because \_\_\_\_\_
- 
- e. Which element has the highest ionization energy? \_\_\_\_\_ The lowest? \_\_\_\_\_