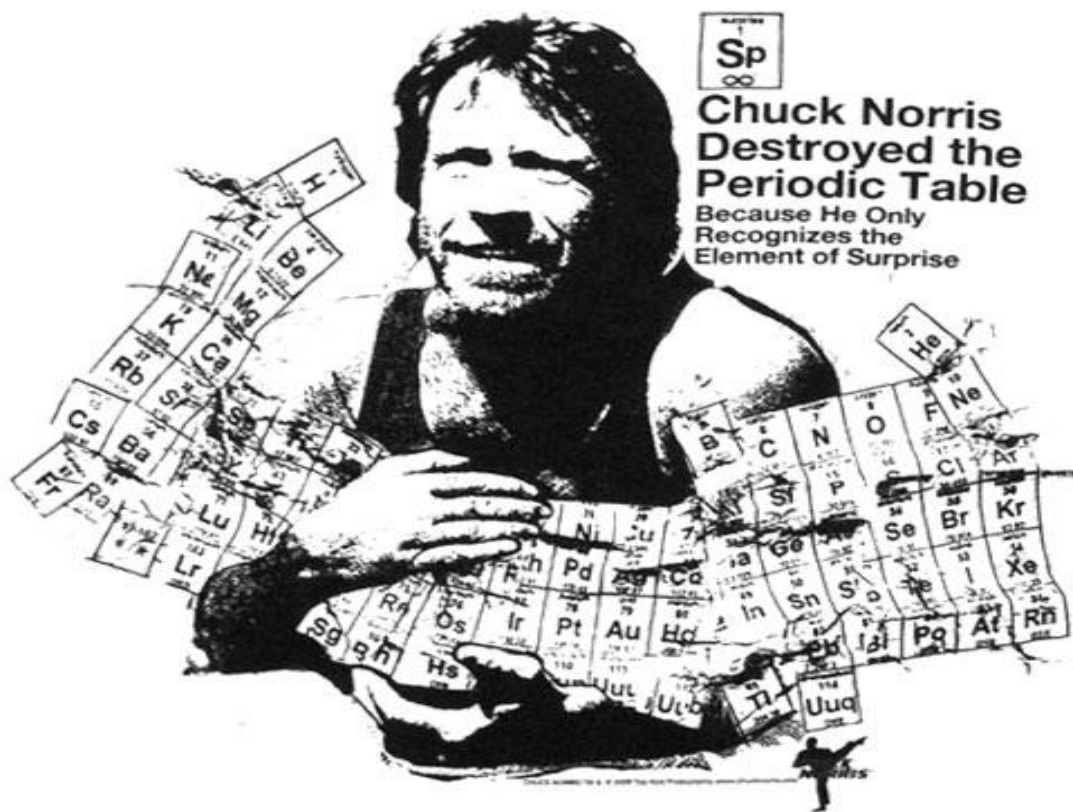


Regents Chemistry:

# Practice Packet Unit: 5

## Periodic Table



# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

## VOCABULARY

For each word, provide a short but specific definition from YOUR OWN BRAIN! No boring textbook definitions. Write something to help you remember the word. Explain the word as if you were explaining it to an elementary school student. Give an example if you can. Don't use the words given in your definition!

Periodic Law: \_\_\_\_\_

Period: \_\_\_\_\_

Group: \_\_\_\_\_

Metal: \_\_\_\_\_

Nonmetal: \_\_\_\_\_

Metalloid/semimetal: \_\_\_\_\_

Alkali metal: \_\_\_\_\_

Alkaline earth metal: \_\_\_\_\_

Transition metal: \_\_\_\_\_

Halogen: \_\_\_\_\_

Noble gas: \_\_\_\_\_

Stable Octet: \_\_\_\_\_

Atomic radius: \_\_\_\_\_

Ionic radius: \_\_\_\_\_

Ionization energy: \_\_\_\_\_

Electronegativity: \_\_\_\_\_

# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

## LESSON 1 DEVELOPMENT OF THE PERIODIC TABLE

**Objective:**

- *Explain how the periodic table was developed*
- *Identify the differences between periods and groups*

1. Who developed the periodic Table? How was it organized?
2. In what order are the elements on the periodic table arranged today?
3. What do the groups have in common?
4. What do the periods have in common?
5. Using the Periodic Table, determine the number of valence electrons in atoms of the following elements, and the Principal Energy Level in which they will be found:

Element	# of Valence electrons	# of energy levels	Element	# of Valence electrons	# of energy levels
Li			Na		
Mg			Ca		
Al			Ga		
Ge			Sn		
N			P		
Se			Te		
Cl			I		
Kr			Rn		

## PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

6. Explain how the number of valence electrons affects the reactivity of elements?

7. Which elements are most reactive and why?

8. Draw the Bohr diagrams for Neon and Helium and explain why they do not bond:



---

---

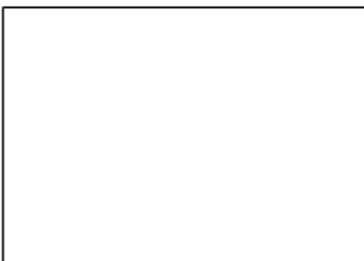
---

---

---

---

Draw the Bohr diagrams for Sodium and Calcium and explain why **metals lose electrons**:



---

---

---

---

---

---

Draw the Bohr diagrams for Fluorine and Sulfur and explain why **nonmetals gain electrons**:



---

---

---

---

---

---

## PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

### Regents Question Practice:

- 
- The elements in Period 4 on the Periodic Table are arranged in order of increasing
    - atomic radius
    - atomic number
    - number of valence electrons
    - number of occupied shells of electrons
  - The elements on the Periodic Table are arranged in order of increasing
    - atomic mass
    - atomic number
    - molar mass
    - oxidation number
  - Which list includes elements with the most similar chemical properties?
    - Br, Ga, Hg
    - Cr, Pb, Xe
    - O, S, Se
    - N, O, F
  - The chemical properties of calcium are most similar to the chemical properties of
    - Ar
    - K
    - Mg
    - Sc
  - Which two elements have the most similar chemical properties?
    - Be and Mg
    - Ca and Br
    - Cl and Ar
    - Na and P
  - Which statement identifies the element arsenic?
    - Arsenic has an atomic number of 33.
    - Arsenic has a melting point of 84 K.
    - An atom of arsenic in the ground state has eight valence electrons.
    - An atom of arsenic in the ground state has a radius of 146 pm.
  - Which statement explains why sulfur is classified as a Group 16 element?
    - A sulfur atom has 6 valence electrons.
    - A sulfur atom has 16 neutrons.
    - Sulfur is a yellow solid at STP.
    - Sulfur reacts with most metals.
  - In which set do the elements exhibit the most similar chemical properties?
    - N, O, and F
    - Hg, Br, and Rn
    - Li, Na and K
    - Al, Si and P
  - All of the atoms of the elements in Period 2 have the same number of
    - protons
    - neutrons
    - valence electrons
    - occupied energy levels (shells)
  - The observed regularities in the properties of elements are periodic functions of their
    - atomic numbers
    - mass numbers
    - oxidation states
    - non-valence electrons
- 

ASSESS YOURSELF ON THIS LESSON: \_\_\_\_\_/37

# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

## LESSON 2: CATEGORIES & PROPERTIES OF ELEMENTS

**Objective:**

- Differentiate between the different groups of elements
- Identify the properties specific to each category of element

1. Check all the boxes which describe the element.

	Metal	Metalloid	Nonmetal	Alkaline Metal	Alkaline Earth Metal	Transition metal	Halogen	Noble gas	Monatomic	Diatomic
Sb										
Sr										
Rn										
P										
Pt										
Cs										
S										
Fe										
Br										
Ar										
H										
Si										
B										
F										
He										
Se										
Zn										
Ra										

2. Write in the space, "Group 1 metals", "Group 2 metals", "transition metals", "halogens", or "noble gases" to indicate which group each statement is describing.

a.		Colored solutions
b.		Full valence shell
c.		Most active metals
d.		Most active nonmetals
e.		Monatomic gases
f.		Diatomic elements
g.		Stable and unreactive
h.		7 valence electrons
i.		2 valence electrons
j.		Form ions with a +1 charge

## PRACTICE PACKET: UNIT 5 PERIODIC TABLE

3. Write in the space, “metals”, “metalloids”, or “nonmetals” to indicate which type of element each statement is describing.

a.		Located on the left side of the P.T.
b.		Located on the right side of the P.T.
c.		Solids are brittle
d.		Majority of the elements
e.		Gain electrons to form negative ions
f.		Located along the “staircase”
g.		Have luster
h.		Malleable
i.		Lose electrons to form positive ions
j.		Ductile
k.		Excellent conductors of heat & electricity
l.		Poor electrical & heat conductors
m.		Low electronegativity values
n.		Low ionization energy
o.		High ionization energy
p.		High electronegativity values
q.		Ions are larger than their atoms
r.		Ions are smaller than their atoms

4. Use Table S to fill in the names and states of each element below. Then, check all the boxes which describe the element.

	Name	Physical Properties					Chemical Properties						
		State at STP (s, l, or g)	Brittle	Malleable /ductile	Conductor		Ionization energy		Electro- negativity		Electrons		
					Good	Poor	Low	High	Low	High	Lose	Gain	
C													
Ag													
Mg													
I													
S													
Au													
Fe													
Br													
Ar													
H													
Hg													

# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

## LESSON 3: PERIODIC TRENDS (ATOMIC RADIUS)

### Objective:

- Describe the trend in atomic radius
- Explain why the trend in atomic radius exists

- Using table S, record the radius of Lithium and Fluorine: \_\_\_\_\_ and \_\_\_\_\_.
- As you go across a period the atomic radius \_\_\_\_\_ because there are more \_\_\_\_\_  
\_\_\_\_\_
- Using table S, record the radius of Beryllium and Magnesium: \_\_\_\_\_ and \_\_\_\_\_.
- As you go down a group the atomic radius \_\_\_\_\_ because there are more \_\_\_\_\_  
\_\_\_\_\_
- An atom of which element has the largest atomic radius?  
a. Fe    b. Mg    c. Si    d. Zn
- Which characteristics both generally *decrease* when the elements in Period 3 on the Periodic Table are considered in order from left to right?  
a. nonmetallic properties and atomic radius  
b. nonmetallic properties and ionization energy  
c. metallic properties and atomic radius  
d. metallic properties and ionization energy
- As atomic number increases within Group 15 on the Periodic Table, atomic radius  
a. decreases, only  
b. decreases, then increases  
c. increases, only  
d. increases, then decreases
- How do the atomic radius and metallic properties of sodium compare to the atomic radius and metallic properties of phosphorus?  
a. Sodium has a larger atomic radius and is more metallic.  
b. Sodium has a larger atomic radius and is less metallic.  
c. Sodium has a smaller atomic radius and is more metallic.  
d. Sodium has a smaller atomic radius and is less metallic.
- and is more metallic.  
d. Sodium has a smaller atomic radius and is less metallic.
- Which list of elements from Group 2 on the Periodic Table is arranged in order of increasing atomic radius?  
a. Be, Mg, Ca                      b. Ca, Mg, Be  
c. Ba, Ra, Sr                      d. Sr, Ra, Ba
- The data table below shows elements Xx, Yy, and Zz from the same group on the Periodic Table.

Element	Atomic Mass (atomic mass unit)	Atomic Radius (pm)
Xx	69.7	141
Yy	114.8	?
Zz	204.4	171

What is the most likely atomic radius of element Yy?  
a. 103 pm    b. 127 pm    c. 166 pm    d. 185 pm



## PRACTICE PACKET: UNIT 5 PERIODIC TABLE



11. As the elements in Period 2 of the Periodic Table are considered in succession from left to right, there is a decrease in atomic radius with increasing atomic number. This may best be explained by the fact that the
- number of protons increases, and the number of shells of electrons remains the same
  - number of protons increases, and the number of shells of electrons increases
  - number of protons decreases, and the number of shells of electrons remains the same
  - number of protons decreases, and the number of shells of electrons increases
12. Which of the following electron configurations represents the element with the smallest atomic radius?
- 2-4
  - 2-5
  - 2-6
  - 2-7
13. Which electron configuration represents the atom with the largest atomic radius?
- 1
  - 2-1
  - 2-2
  - 2-3
14. As the elements of Group 16 are considered in order from top to bottom, the covalent radius of each successive element increases. This increase is primarily due to an increase in
- atomic number
  - mass number
  - the number of protons occupying the nucleus
  - the number of occupied electron shells
15. An ion of which element has a larger radius than an atom of the same element?
- aluminum
  - Magnesium
  - chlorine
  - sodium
16. An atom with the electron configuration 2-8-2 would most likely
- decrease in size as it forms a positive ion
  - increase in size as it forms a positive ion
  - decrease in size as it forms a negative ion
  - increase in size as it forms a negative ion
17. The radius of a calcium ion is smaller than the radius of a calcium atom because the calcium ion contains the same nuclear charge and
- fewer protons
  - fewer electrons
  - more protons
  - more electrons
18. A chloride ion *differs* from a chlorine atom in that the chloride ion has
- more protons
  - a larger radius
  - fewer protons
  - a smaller radius
19. How does the size of a barium ion compare to the size of a barium atom?
- The ion is smaller because it has fewer electrons.
  - The ion is smaller because it has more electrons.
  - The ion is larger because it has fewer electrons.
  - The ion is larger because it has more electrons.

# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

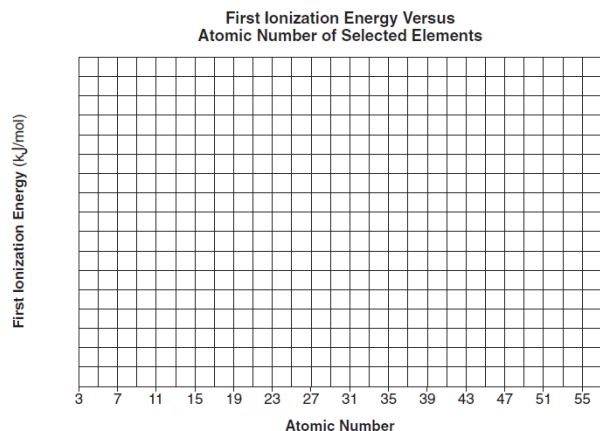
## LESSON 4: PERIODIC TRENDS (IONIZATION ENERGY & ELECTRONEGATIVITY)

### Objective:

- Describe the trend in ionization energy and electronegativity
- Explain why these trends exist

- Base your answers to the following questions on the information below.
  - Complete the table BELOW.
  - On the grid below, mark an appropriate scale on the axis labeled "First Ionization Energy (kJ/mol)." An appropriate scale is one that allows a trend to be seen.
  - On the grid, plot the data from the table. Circle and connect the points.

### First Ionization Energy of Group 1 Elements



Element	Atomic Number	First Ionization Energy (kJ/mol)
lithium	3	
sodium	11	
potassium	19	
rubidium	37	
cesium	55	

- State the trend in first ionization energy for the elements in the table as atomic number increases. [1]

- Complete the table below by checking the appropriate boxes.

	Across a Period →		Down a Group ↓	
	Increases	Decreases	Increases	Decreases
Atomic radius				
Metallic character				
Ionization energy				
Electronegativity				
Why?	# of protons (nuclear pull)		# of electron shells	

## PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

7. Complete the statements below by checking the correct box.

		increases	decreases	remains the same
a.	As the elements in a Period are considered from left to right, the number of valence electrons in each successive element...			
b.	As the elements in Group 17 are considered from top to bottom, the number of valence electrons in each successive element...			
c.	Going left to right across a Period, the number of electron shells...			
d.	As the elements in a Group are considered from top to bottom, the number of electron shells...			
e.	As the elements in Group 1 are considered from top to bottom, the reactivity of each successive element....			
f.	As the elements in Group 17 are considered from top to bottom, the reactivity of each successive element...			

8. Explain the following in terms of *atomic structure*:

- Cesium has a larger atomic radius than rubidium.
- Cesium has a *lower* first ionization energy than rubidium.
- Bromine has a *lower* first ionization energy than chlorine.
- The atomic radius of copper is 128 picometers while Ag has an atomic radius of 144 picometers.



# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

## UNIT 5 REVIEW/STUDY GUIDE

### THE PERIODIC LAW

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. \_\_\_\_\_

\_\_\_\_\_

### METALS, NONMETALS, AND METALLOIDS

**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

**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? \_\_\_\_\_

**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

# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

## GROUPS AND PERIODS

**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? \_\_\_\_\_

**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

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

# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

## ATOMIC RADIUS

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

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? \_\_\_\_\_

\_\_\_\_\_

f. Which element has the highest electronegativity? \_\_\_\_\_

# PRACTICE PACKET: UNIT 5 PERIODIC TABLE

---

## IONIZATION ENERGY

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.

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

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.

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