

# Practice Packet

## Unit: 7 - Periodic Table

the periodic table of procrastination

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## Practice Packet: Unit 7 - Periodic Table

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### Periodic Table IMPORTANT Vocabulary

**Periodic Table** – a chart that organizes information about all of the known elements according to their atomic number.

**Element** – a substance that cannot be broken down into a simpler substance by ordinary chemical means.

**Atom** – the smallest unit of an element that has all of the properties of the element; basic building block of matter.

**Atomic Mass** – the number of protons and neutrons in the nucleus of one atom of the element. Located under the elemental symbol (at the bottom of the element box on the periodic table).

**Atomic Number** – the number of protons contained in each nucleus of its atoms of the element. Located over the elemental symbol (at the top of the element box on the periodic table).

**Period** – a horizontal row (left to right) in the periodic table.

**Group** – a vertical column (up and down) on the periodic table.

**Reactivity** – describes how likely an element is to form bonds with other elements.

**Valence Electrons** – electrons that are located in the outermost energy level of an atom.

**Ion** – an atom that has gained or lost one or more valence electrons.

**Metal** – an element or substance that conducts heat and electricity, is malleable and ductile and has low ionization energy and low electronegativity values. Metals tend to lose their electrons to form cations. Metals are found on the left side of the boron staircase.

**Nonmetal** – an element that does not conduct electricity or heat and is usually a gas at room temperature. Nonmetals are brittle, have high ionization energies and high electronegativity values. Nonmetals tend to gain electrons to form anions. Nonmetals are found on the right side of the boron staircase.

**Metalloid** – an element that has some properties of a metal and some properties of a nonmetal. The metalloids are found on the boron staircase, there are 6 metalloids: B, Si, Ge, As, Sb, Te

**Inert** – elements and/or compounds that when put together are unable to react chemically. The noble gases (group 18) elements are inert because of a full valence shell.

**Alkali Metals** – Group 1 metals on the periodic table that contain 1 valence electron and lose their valence electrons the most easily, making them the most reactive metals.

**Alkaline Earth Metals** – Group 2 metals on the periodic table that contain 2 valence electrons and are the second most reactive metals.

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**Transition Metals** – Group 3-12 on the periodic table. They have varying valence electrons and do not follow the normal trends of the other metals. They form brightly colored compounds and ions in solution.

**Halogens** – Group 17 nonmetals on the periodic table that contain 7 valence electrons. They only need to gain 1 valence electron to have a stable octet. They gain valence electrons the most readily, making them the most reactive nonmetals.

**Noble Gases** – Group 18 elements on the periodic table that contain 8 valence electrons (He has 2) and a full valence shell making them very stable and inert. All other atoms change their valence configurations to attain a full octet like the noble gases.

**Atomic Radius** – The distance between the nucleus of an atom and its outermost energy level (valence shell).

**Electronegativity** – The attraction a nucleus has for electrons in a chemical bond.

**First Ionization Energy** – The energy required to remove an electron from the outermost energy level (valence electron)

**Nuclear Charge** – The charge of an atom's nucleus resulting from its number of protons.

**Nuclear Shielding** – A shielding effect that multiple principle energy levels has on a nucleus blocking its attraction for the valence electrons.

## Introduction to the Periodic Table:

### Color Coding Activity

The Periodic Table is a list of all the known elements. It is organized by increasing atomic number. There are two main groups on the periodic table: metals and nonmetals. The left side of the table contains elements with the greatest metallic properties. As you move from the left to the right, the elements become less metallic with the far right side of the table consisting of nonmetals. A small group of elements, whose members touch the zigzag line, are called metalloids because they have both metallic and nonmetallic properties. Identify the *zig zag* line and make it more bold using a black crayon.

The table is also arranged in vertical columns called “groups” or “families” and horizontal rows called “periods.” Each arrangement is significant. The elements in each vertical column or group have similar properties. There are a number of major groups with similar properties. They are as follows:

Hydrogen: This element does not match the properties of any other group so it stands alone. It is placed above group 1 but it is not part of that group. It is a very reactive, colorless, odorless gas at room temperature. (1 outer level electron) Outline Hydrogen in red.

Group 1: Alkali Metals – These metals are extremely reactive and are never found in nature in their pure form. They are silver colored and shiny. Their density is extremely low so that they are soft enough to be cut with a knife. (1 outer level electron) Color the alkali metals in red.

Group 2: Alkaline-earth Metals – Slightly less reactive than alkali metals. They are silver colored and more dense than alkali metals. (2 outer level electrons) Color the alkaline earth metals in orange.

Groups 3 – 12: Transition Metals – These metals have a moderate range of reactivity and a wide range of properties. In general, they are shiny and good conductors of heat and electricity. They also have higher densities and melting points than groups 1 & 2. (1 or 2 outer level electrons) Color the transition metals in pink.

Lanthanides and Actinides: These are also transition metals that were taken out and placed at the bottom of the table so the table wouldn't be so wide. The elements in each of these two periods share many properties. The lanthanides are shiny and reactive. The actinides are all radioactive and are therefore unstable. Elements 95 through 103 do not exist in nature but have been manufactured in the lab. Color the lanthanides and actinides brown.

Group 13: Contains one metalloid and 4 metals. Reactive. Aluminum is in this group. It is also the most abundant metal in the earth's crust. (3 outer level electrons) Color group 13 yellow.

Group 14: Contains one nonmetal, two metalloids, and two metals. Varied reactivity. (4 outer level electrons) Color group 14 light green.

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Group 15: Contains two nonmetals, two metalloids, and one metal. Varied reactivity. (5 outer level electrons) Color group 15 dark green.

Group 16: Contains three nonmetals, one metalloid, and one metal. Reactive group. (6 outer level electrons) Color group 16 light blue.

Group 17: Halogens – All nonmetals. Very reactive. Poor conductors of heat and electricity. Tend to form salts with metals. Ex. NaCl: sodium chloride also known as “table salt”. (7 outer level electrons) Color group 17 dark blue.

Group 18: Noble Gases – Unreactive nonmetals. All are colorless, odorless gases at room temperature. All found in earth’s atmosphere in small amounts. (8 outer level electrons) Color group 18 Purple.

### Analysis:

1. The vertical columns on the periodic table are called \_\_\_\_\_.
2. The horizontal rows on the periodic table are called \_\_\_\_\_.
3. Most of the elements in the periodic table are classified as \_\_\_\_\_.
4. The elements that touch the zigzag line are classified as \_\_\_\_\_.
5. The elements in the far upper right corner are classified as \_\_\_\_\_.
6. Elements in the first group have one outer shell electron and are extremely reactive. They are called \_\_\_\_\_.
7. Elements in the second group have 2 outer shell electrons and are also very reactive. They are called \_\_\_\_\_.
8. Elements in groups 3 through 12 have many useful properties and are called \_\_\_\_\_.
9. Elements in group 17 are known as “salt formers”. They are called \_\_\_\_\_.
10. Elements in group 18 are very unreactive. They are said to be “inert”. We call these the \_\_\_\_\_.
11. The elements at the bottom of the table were pulled out to keep the table from becoming too long. The first period at the bottom called the \_\_\_\_\_.
12. The second period at the bottom of the table is called the \_\_\_\_\_.



**Inquiry Activity: Introduction to Periods and Groups**

**Look at the periodic table of elements.**

1. Periods represent the (vertical/horizontal) rows on the table.
2. Draw Bohr diagrams for Carbon, Boron and Oxygen, all in period 2.
  
3. Based on your diagrams in question 2, elements in the same period have the same # of \_\_\_\_\_.
4. Groups represent the (vertical/horizontal) columns on the table.
5. Draw Bohr diagrams for Lithium, Sodium, and Potassium (all in group 1).
  
6. Based upon your diagrams in question 5, elements in the same group have the same # of \_\_\_\_\_.

**RULES:** Group 1 are known as Alkali Metals. Group 2 are Alkaline earth metals. Groups 3-12 are Transition metals. Group 17 are Halogens. Group 18 are Noble gases. All other groups do not have names.

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

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### Periods and Groups Summary

Look at the periodic table of elements.

1. How many periods are on the periodic table of elements?
2. What do elements in the same period have in common?
3. Write out Lewis dot diagrams for any three elements in group 18.
4. What do elements in the same group have in common?

### Periodic Trends

5. Look up the atomic radius for Na and Cl (period 3 elements) on Table S.

Na = \_\_\_\_\_ Cl= \_\_\_\_\_

What is the trend in atomic radius going across a period? (increasing/decreasing)

6. Look up the atomic radius for Be and Ba (group 2 elements) on Table S.

Be = \_\_\_\_\_

Ba= \_\_\_\_\_

What is the trend in atomic radius going down a group? (increasing/decreasing)

7. Why do you think the trend in question 6 exists?

## Practice Packet: Unit 7 - Periodic Table

**LESSON 7.1: DEVELOPMENT OF THE PERIODIC TABLE****Objective:**

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

1. Who initially 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. Explain how the number of valence electrons affects the reactivity of elements?
6. Which metals are most reactive and why?
7. Which nonmetals are most reactive and why?
8. Draw the Bohr diagrams for Neon and Helium and explain why they are unreactive (do not bond):



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9. Draw the Bohr diagrams for Sodium and Calcium and state whether **metals** gain or lose electrons when forming ions:

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10. Draw the Bohr diagrams for Fluorine and Sulfur and state whether **metals** gain or lose electrons when forming ions:

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### REGENTS PRACTICE

- In terms of valence electrons, why do Na and Li have similar properties?
- What two elements have similar reactivity and why? Ca, Sr, Ti, Zr.
- If sodium reacts with water, would you expect potassium to react with water as well? Why or why not.
- Which elements have the most similar chemical properties?
 

A) K and Na	C) K and Cl
B) K and Ca	D) K and S

### ASSESS YOURSELF ON THIS LESSON:

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## Practice Packet: Unit 7 - Periodic Table

### LESSON 7.2: CATEGORIES & PROPERTIES OF ELEMENTS

**Objective:**

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

1. 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.		Can form 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

2. 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 Periodic Table
b.		Located on the right side of the Periodic Table
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.		Ions are larger than their atoms
n.		Ions are smaller than their atoms

# Practice Packet: Unit 7 - Periodic Table

## REGENTS PRACTICE

- Which three groups of the Periodic Table contain the most elements classified as metalloids (semimetals)?  
A) 1, 2, and 13                      B) 2, 13, and 14  
C) 14, 15, and 16                      D) 16, 17, and 18
- The metalloids that are included in Group 15 are antimony and  
A) N      B) P              C) As      D) Bi
- Which element is a member of the halogen family?  
A)K      B)B              C)I      D)S
- Which represents the electron configuration of a metalloid?  
A) 2-3B) 2-5 C) 2-8-5 D) 2-8-6
- An atom of an element contains 20 protons, 20 neutrons, and 20 electrons. This element is in Group  
A)1                      B)2                      C)4                      D)18
- Which sequence of atomic numbers represents elements which have similar chemical properties?  
A) 19, 23, 30, 36                      B) 9, 16, 33, 50  
C) 3, 12, 21, 40                      D) 4, 20, 38, 88
- Alkali metals, alkaline earth metals, and halogens are elements found respectively in Groups  
A) 1, 2, and 18                      B) 2, 13, and 17  
C) 1, 2, and 14                      D) 1, 2, and 17
- Which group contains elements composed of diatomic molecules at STP?  
A)11                      B)2                      C)7                      D)17
- On the Periodic Table, an element classified as a semimetal (metalloid) can be found in  
A) Period 6, Group 15      B) Period 2, Group 14  
C) Period 3, Group 16      D) Period 4, Group 15
- Atoms of metallic elements tend to  
A) gain electrons and form negative ions  
B) gain electrons and form positive ions  
C) lose electrons and form negative ions  
D) lose electrons and form positive ions
- Which element is considered malleable?  
A) gold                      B) hydrogen  
C) sulfur                      D) radon
- Which element is malleable and conducts electricity?  
A) iron                      B) iodine  
C) sulfur                      D) phosphorus
- Which element is malleable and ductile?  
A) S      B) Si      C) Ge      D) Au
- Which element is brittle and does *not* conduct heat or electricity?  
A) S(s)      B) Mg(s)      C) Al(s)      D) K(s)
- Which element is an active nonmetal?  
A) Neon      B) oxygen      C) zinc      D) chromium
- Which characteristics describe most solid nonmetals?  
A) They are malleable and have metallic luster.  
B) They are malleable and lack metallic luster.  
C) They are brittle and have metallic luster.  
D) They are brittle and lack metallic luster.
- An atom in the ground state has a stable valence electron configuration. This atom could be an atom of  
A) Al      B) Cl      C) Na      D) Ne
- Which element is a metalloid?  
A) Al      B) Ar      C) As      D) Au
- Magnesium and calcium have similar chemical properties because a magnesium atom and a calcium atom have the same  
A) atomic number  
B) mass number  
C) total number of electron shells  
D) total number of valence electro

### ASSESS YOURSELF ON THIS LESSON:

If you missed any regents practice questions you should see me for extra help and/or re-watch the lesson video assignment

**MORE PERIODIC TABLE ORGANIZATION & PROPERTIES OF ELEMENTS****PRACTICE (regents questions)**

- This element 2-8-6 belongs in period  
(1) 6 (3) 3  
(2) 2 (4) 4
- Most of the elements in the Periodic Table are classified as  
(1) metalloids (3) nonmetals  
(2) noble gases (4) metals
- Phosphorus is best classified as a  
(1) nonmetal (3) metalloid  
(2) metal (4) noble gas
- The elements in Group 2 have similar chemical properties primarily because they have the same  
(1) ionization energies  
(2) number of subatomic particles  
(3) number of principal energy levels  
(4) number of electrons in the outermost shell
- In which group of the Periodic Table would this element, 2-5, most likely be found?  
(1) 1 (3) 14  
(2) 2 (4) 15
- As the elements in Period 3 are considered in order of increasing atomic number, the number of principal energy levels in each successive element  
(1) decreases  
(2) increases  
(3) remains the same
- Which group contains elements which are metalloids?  
(1) 1 (3) 11  
(2) 14 (4) 4
- Which element is a metalloid?  
(1) arsenic (3) neon  
(2) potassium (4) bromine
- Chlorine is most similar in chemical activity to  
(1) carbon (3) argon  
(2) sulfur (4) iodine
- What are two properties of most nonmetals?  
(1) brittle and poor electrical conductivity  
(2) brittle and good electrical conductivity  
(3) malleable and poor electrical conductivity  
(4) malleable and good electrical conductivity
- Which element is a noble gas at STP?  
(1) hydrogen (3) neon  
(2) oxygen (4) nitrogen
- In which shell are the valence electrons of the elements in Period 2 found?  
(1) 1 (3) 3  
(2) 2 (4) 4
- Which of the following elements is the best conductor of electricity?  
(1) Li (3) C  
(2) O (4) N
- Which group in the periodic table contains both metals and nonmetals?  
(1) 11 (3) 18  
(2) 2 (4) 14
- Which period contains elements that are all gases at STP?  
(1) 1 (3) 3  
(2) 2 (4) 4
- Which of the following groups of elements contain 2 metalloids?  
(1) Al, Si, C (3) Si, Ge, Sn  
(2) Sb, Po, Se (4) Al, Po, Si
- The only metal which is a liquid at STP is in period  
(1) 5 (3) 3  
(2) 6 (4) 4

**GROUPS OF ELEMENTS (regents practice)**Group Characteristics

- \_\_\_ 1. The alkali metals all have the same  
 (1) electronegativity (3) atomic radius  
 (2) oxidation # (4) ionization energy
- \_\_\_ 2. The alkaline earth metals are those elements in group  
 (1) 1 (3) 11  
 (2) 2 (4) 12
- \_\_\_ 3. Which group in the periodic table contains the alkali metals?  
 (1) 1 (3) 17  
 (2) 2 (4) 18
- \_\_\_ 4. Which is an alkaline earth metal?  
 (1) Na (3) Ca  
 (2) Ga (4) Ta
- \_\_\_ 5. A metallic element whose aqueous ions produce colorless solutions would be found in Period 4 and Group  
 (1) 1 (3) 17  
 (2) 8 (4) 18
- \_\_\_ 6. Which is a transition element?  
 (1) Ag (3) Mg  
 (2) Sb (4) Si
- \_\_\_ 7. Which group of elements exhibits all three phases of matter at room temperature?  
 (1) 1 (3) 17  
 (2) 12 (4) 18
- \_\_\_ 8. Which element is classified as a noble gas at STP?  
 (1) hydrogen (3) neon  
 (2) oxygen (4) nitrogen

- \_\_\_ 9. Which group contains elements that are never found uncombined in nature?  
 (1) 18 (3) 3  
 (2) 13 (4) 17
- \_\_\_ 10. Elements in which electrons from more than one energy level may be involved in bond formation are called  
 (1) alkali metals (3) alkaline earth metals  
 (2) transition metals (4) halogens
- \_\_\_ 11. Which group in the Periodic Table contains the most active nonmetals?  
 (1) alkali metals (3) halogens  
 (2) transition metals (4) noble gases
- \_\_\_ 12. When the compound  $XCl_2$  is dissolved in water, the resulting solution is blue. Element  $X$  could be  
 (1) Na (3) Cu  
 (2) Mg (4) Al
- \_\_\_ 13. Which group in the Periodic Table contains the most active metals?  
 (1) 1 (3) 11  
 (2) 17 (4) 7
- \_\_\_ 14. Which gas is monatomic at STP?  
 (1) chlorine (3) neon  
 (2) fluorine (4) nitrogen
15. Explain, in terms of atomic structure, why the noble gas neon is an unreactive element.

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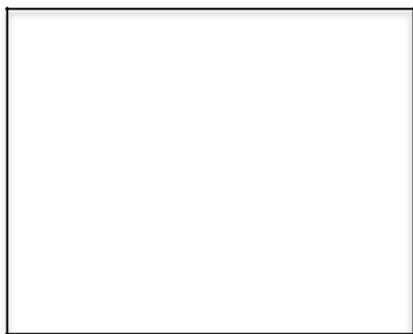
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## PERIODIC TRENDS (ATOMIC RADIUS)

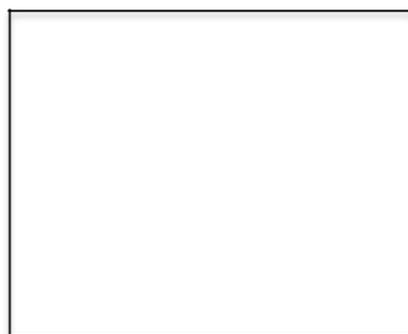
**Objective:***Describe the trend in atomic radius**Explain why this trend in atomic radius exists*

<https://teachchemistry.org/periodical/issues/march-2016/periodic-trends-ionization-energy-atomic-radius-ionic-radius>

1. Draw the Bohr Model for Lithium and Potassium. Then look up the atomic radius and write it in the space provided.

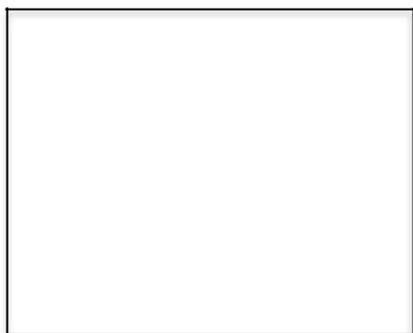


Atomic Radius: \_\_\_\_\_

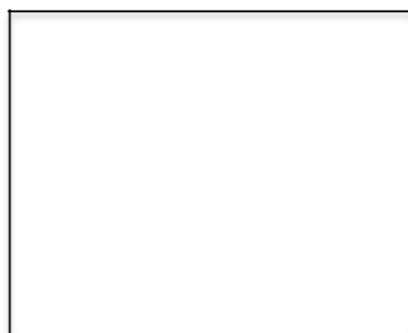


Atomic Radius: \_\_\_\_\_

2. Using the models above, what is the trend in atomic radius going down a group?
3. Why does this trend exist?
4. Draw the Bohr diagram for sodium and chlorine. Then look up the atomic radius and write it in the space provided.



Atomic Radius: \_\_\_\_\_



Atomic Radius: \_\_\_\_\_

5. What is the trend in atomic radius going across a period?

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6. Why does this trend exist?

**What you need to know.....**

Atomic Radius \_\_\_\_\_ across a period because \_\_\_\_\_

Atomic Radius \_\_\_\_\_ down a group because \_\_\_\_\_

**REGENTS PRACTICE**1. An atom of which element has the largest radius?  
a. Fe    b. Mg    c. Si    d. Zn2. 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 decreases3. How do the atomic radius and metallic properties of Na compare to the atomic radius and metallic properties of P?  
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.4. Which list of elements from Group 2 is arranged in order of increasing radius?  
a. Be, Mg, Ca                      b. Ca, Mg, Be  
c. Ba, Ra, Sr                        d. Sr, Ra, Ba

5. 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

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6. As the elements in Period 2 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, 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, the number of shells of electrons remains the same
  - number of protons decreases, and the number of shells of electrons increases
7. Which of the following electron configurations represents the element with the smallest radius?
- 2-4
  - 2-5
  - 2-6
  - 2-7
8. Which electron configuration represents the atom with the largest atomic radius?
- 1
  - 2-1
  - 2-2
  - 2-3
9. 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
10. An ion of which element has a larger radius than an atom of the same element?
- aluminum
  - Magnesium
  - chlorine
  - sodium
11. 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
12. 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
13. A chloride ion *differs* from a chlorine atom in that the chloride ion has
- more protons
  - a larger radius
  - fewer protons
  - a smaller radius
14. 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.

**ASSESS YOURSELF ON THIS LESSON:**

If you missed any regents practice questions you should see me for extra help and/or re-watch the lesson video assignment

**PERIODIC TRENDS (IONIZATION ENERGY)****Objective:**

*Describe the trend in ionization energy Explain why this trend exists*

1. What is ionization energy?
2. What subatomic particle is responsible for the ionization energy of an atom?
3. Which atom (Na or K) has a larger ionization energy and why?
4. Do metals typically have higher or lower ionization energies?
5. Why do nonmetals typically have higher ionization energies?

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

1. Cesium has a *lower* first ionization energy than rubidium.
2. Bromine has a *lower* first ionization energy than chlorine.
3. Beryllium has a *higher* first ionization energy than lithium.
4. Calcium has a *higher* first ionization energy than potassium.

**What you need to know.....**

Ionization Energy \_\_\_\_\_ across a period because \_\_\_\_\_

Ionization Energy \_\_\_\_\_ down a group because \_\_\_\_\_

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## REGENTS PRACTICE

1. Which general trend is found in Period 2 on the Periodic Table as the elements are considered in order of increasing atomic number?
- Decreasing atomic mass
  - increasing ionization energy
  - increasing atomic radius
2. As the elements of Group 1 on the Periodic Table are considered in order of increasing atomic radius, the ionization energy of each successive element generally
- decreases
  - remains the same
  - increases
3. The amount of energy required to remove the outermost electron from a gaseous atom in the ground state is known as
- first ionization energy
  - conductivity
  - activation energy
  - electronegativity
4. Which atom in the ground state requires the *least amount of energy to remove its valence electron*?
- lithium atom
  - potassium atom
  - rubidium atom
  - sodium atom
5. Which element requires the *least* amount of energy to remove the most loosely held electron from its atom?
- bromine
  - calcium
  - sodium
  - silver
6. Samples of four Group 15 elements, antimony, arsenic, bismuth, and phosphorus, are in the gaseous phase. An atom in the ground state of which element requires the *least* amount of energy to remove its most loosely held electron?
- As
  - Bi
  - P
  - Sb
7. In the ground state, each atom of an element has two valence electrons. This element has a lower first ionization energy than calcium. Where is this element located on the Periodic Table?
- Group 1, Period 4
  - Group 2, Period 3
  - Group 2, Period 5
  - Group 3, Period 4
8. Which electron configuration represents an element with the highest first ionization energy?
- 2-1
  - 2-2
  - 2-8-1
  - 2-8-2
9. What does the second ionization energy refer to?
- Removing two electrons at once
  - Removing the second electron from the valence
  - Adding an electron back to the ion
10. Which element can have the following ionization energies:
- | First | Second | Third | Fourth |
|-------|--------|-------|--------|
| 250   | 500    | 2500  | 2800   |
- K
  - Mg
  - O
  - F
11. Which element can have the following ionization energies:
- | First | Second | Third | Fourth |
|-------|--------|-------|--------|
| 100   | 700    | 900   | 1000   |
- K
  - Mg
  - O
  - F
12. Low ionization energies are most characteristic of atoms that are
- metals
  - metalloids
  - nonmetals
  - noble gases

## ASSESS YOURSELF ON THIS LESSON:

If you missed any regents practice questions you should see me for extra help and/or re-watch the lesson video assignment

**PERIODIC TRENDS (ELECTRONEGATIVITY)****Objective:**

- Describe the trend in electronegativity energy
- Explain why this trend exists

1. What is electronegativity?
2. Which element has the highest electronegativity?
3. What subatomic particle is responsible for the electronegativity of an atom?
4. Which atom (Na or Cl) has a larger electronegativity and why?
5. Do metals typically have higher or electronegativity?
6. Why do nonmetals typically have higher electronegativity?

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

6. Cesium has a *lower* electronegativity than rubidium.
7. Bromine has a *lower* electronegativity than chlorine.
8. Beryllium has a *higher* electronegativity than lithium.
9. Calcium has a *higher* electronegativity than potassium.

**What you need to know.....**

Electronegativity \_\_\_\_\_ across a period because \_\_\_\_\_

Electronegativity \_\_\_\_\_ down a group because \_\_\_\_\_

**MIXED PERIODIC TRENDS REGENTS REVIEW**

- 1) Based upon your knowledge of metallic activity, which element would most readily react with water?  
A) Zn    B) Cu    C) Fe    D) Li
- 2) Which of the following groups in the Periodic Table contain elements so highly reactive they are never found in the free state?  
A) 1 and 2                      B) 1 and 11  
C) 2 and 15                      D) 11 and 15
- 3) In which of the following elements is the *least* amount of energy required to remove the most loosely bound electron from an atom in the gaseous state?  
A) Sr    B) Ar    C) Al    D) Cl
- 4) Which noble gas has the highest first ionization energy?  
A) radon                      B) krypton  
C) neon                        D) helium
- 5) An Mg atom differs from an  $Mg^{2+}$  ion in that the atom has a  
A) smaller radius            B) larger radius  
C) smaller nucleus         D) larger nucleus
- 6) As the elements in Period 3 are considered from left to right, they tend to  
A) lose electrons more readily and increase in metallic character  
B) lose electrons more readily and increase in nonmetallic character  
C) gain electrons more readily and increase in metallic character  
D) gain electrons more readily and increase in nonmetallic character
- 7) As elements of Group 15 of the Periodic Table are considered in order from top to bottom, the metallic character of the atoms of each successive element generally  
A) decreases                      B) increases  
C) remains the same
- 8) Which element in Period 2 of the Periodic Table is the most reactive nonmetal?  
A) carbon                        B) nitrogen  
C) oxygen                        D) fluorine
- 9) Which statement best compares the atomic radius of a potassium atom and the atomic radius of a calcium atom?  
A) The radius of the potassium atom is smaller because of its smaller nuclear charge.  
B) The radius of the potassium atom is smaller because of its larger nuclear charge.  
C) The radius of the potassium atom is larger because of its smaller nuclear charge.  
D) The radius of the potassium atom is larger because of its larger nuclear charge.
- 10) Which element is most likely to gain electrons in a chemical reaction?  
A) Kr    B) Br    C) Ca    D) Ba
- 11) What occurs as the atomic number of the elements in Period 2 increases?  
A) The nuclear charge of each successive atom decreases, and the atomic radius decreases.  
B) The nuclear charge of each successive atom decreases, and the atomic radius increases.  
C) The nuclear charge of each successive atom increases, and the atomic radius decreases.  
D) The nuclear charge of each successive atom increases, and the atomic radius increases.

## Practice Packet: Unit 7 - Periodic Table

- 12) Which of these elements in Period 3 has the *least* tendency to attract electrons?  
 A) Mg B) Al C) S D) Cl
- 13) 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  
 A) fewer protons B) more protons  
 C) fewer electrons D) more electrons
- 14) Atoms of which of the following elements have the *smallest* atomic radius?  
 A) Si B) P C) S D) Cl
- 15) How does the size of an aluminum atom change when it becomes an ion with a charge of  $3^+$ ?  
 A) It becomes smaller by losing 3 electrons.  
 B) It becomes smaller by gaining 3 electrons.  
 C) It becomes larger by losing 3 electrons.  
 D) It becomes larger by gaining 3 electrons.

Before atomic numbers were known, Mendeleev developed a classification system for the 63 elements known in 1872, using oxide formulas and atomic masses. He used an R in the oxide formulas to represent any element in each group. The atomic mass was listed in parentheses after the symbol of each element. A modified version of Mendeleev's classification system is shown in the table below.

**Modified Version of Mendeleev's Table**

Group →		I	II	III	IV	V	VI	VII
Oxide formulas		$R_2O$	$RO$	$R_2O_3$	$RO_2$	$R_2O_5$	$RO_3$	$R_2O_7$
Series	1	H(1)						
	2	Li(7)	Be(9.4)	B(11)	C(12)	N(14)	O(16)	F(19)
	3	Na(23)	Mg(24)	Al(27.3)	Si(28)	P(31)	S(32)	Cl(35.5)
	4	K(39)	Ca(40)		Ti(48)	V(51)	Cr(52)	Mn(55)
	5	Cu(63)	Zn(65)			As(75)	Se(78)	Br(80)
	6	Rb(85)	Sr(87)	Yt(88)	Zr(90)	Nb(94)	Mo(96)	
	7	Ag(108)	Cd(112)	In(113)	Sn(118)	Sb(122)	Te(125)	I(127)
	8	Cs(133)	Ba(137)	Di(138)	Ce(140)			

- 1) Identify *one* characteristic used by Mendeleev to develop his classification system of the elements.
- 2) Based on Mendeleev's oxide formula, what is the number of electrons lost by each atom of the elements in Group III?
- 3) Explain, in terms of chemical reactivity, why the elements in Group 18 on the modern Periodic Table were *not* identified by Mendeleev at that time.

## Practice Packet: Unit 7 - Periodic Table

Base your answers to questions 4 through 7 on the information below

The table below lists physical and chemical properties of six elements at standard pressure that correspond to known elements on the Periodic Table. The elements are identified by the code letters, D, E, G, J, L, and Q.

Properties of Six Elements at Standard Pressure

<b>Element D</b> Density 0.00018 g/cm <sup>3</sup> Melting point -272°C Boiling point -269°C Oxide formula (none)	<b>Element E</b> Density 1.82 g/cm <sup>3</sup> Melting point 44°C Boiling point 280°C Oxide formula E <sub>2</sub> O <sub>5</sub>	<b>Element G</b> Density 0.53 g/cm <sup>3</sup> Melting point 181°C Boiling point 1347°C Oxide formula G <sub>2</sub> O
<b>Element J</b> Density 0.0013 g/cm <sup>3</sup> Melting point -210°C Boiling point -196°C Oxide formula J <sub>2</sub> O <sub>5</sub>	<b>Element L</b> Density 0.86 g/cm <sup>3</sup> Melting point 64°C Boiling point 774°C Oxide formula L <sub>2</sub> O	<b>Element Q</b> Density 0.97 g/cm <sup>3</sup> Melting point 98°C Boiling point 883°C Oxide formula Q <sub>2</sub> O

- 4) What is the total number of elements in the "Properties of Six Elements at Standard Pressure" table that are solids at STP?
- 5) Identify, by code letter, the element that is a noble gas in the "Properties of Six Elements at Standard Pressure" table.
- 6) An atom of element G is in the ground state. What is the total number of valence electrons in this atom?
- 7) Letter Z corresponds to an element on the Periodic Table other than the six listed elements. Elements G, Q, L, and Z are in the same group on the Periodic Table, as shown in the diagram below.

G

Q

L

Z

Based on the trend in the melting points for elements G, Q, and L listed in the "Properties of Six Elements at Standard Pressure" table, estimate the melting point of element Z, in degrees Celsius.

## UNIT REVIEW

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?	<b>Proton Pull increases</b>		<b># of electron shells increases</b>	

2. Write in the space, "metals", "metalloids", or "nonmetals" to indicate which type of element.

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