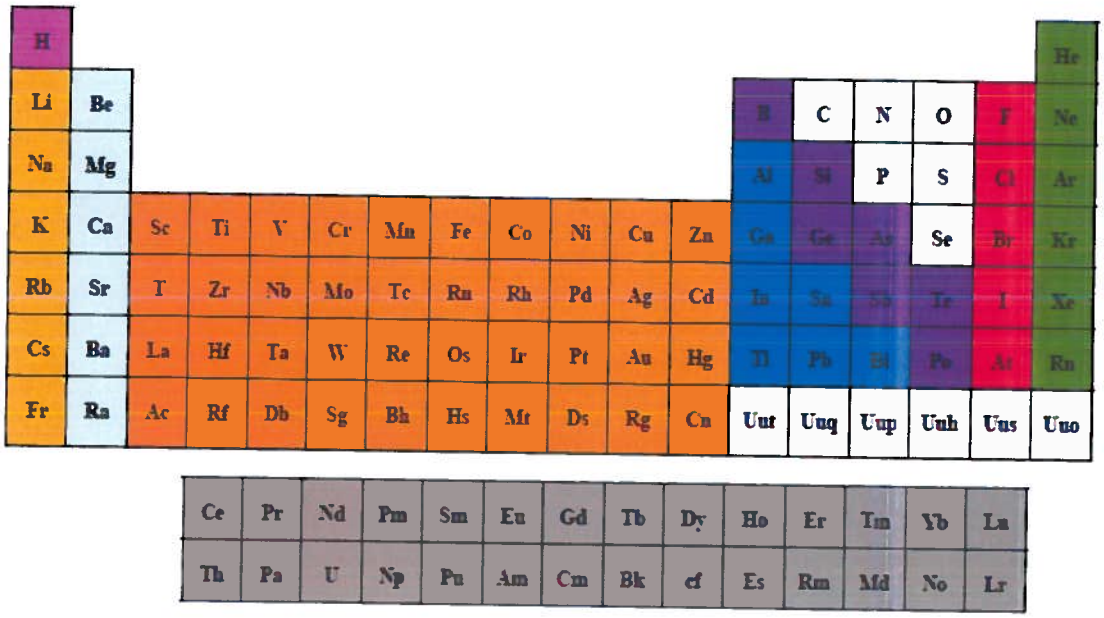
STUDENT *STUDENT*

Regents Chemistry

PRACTICE PACKET

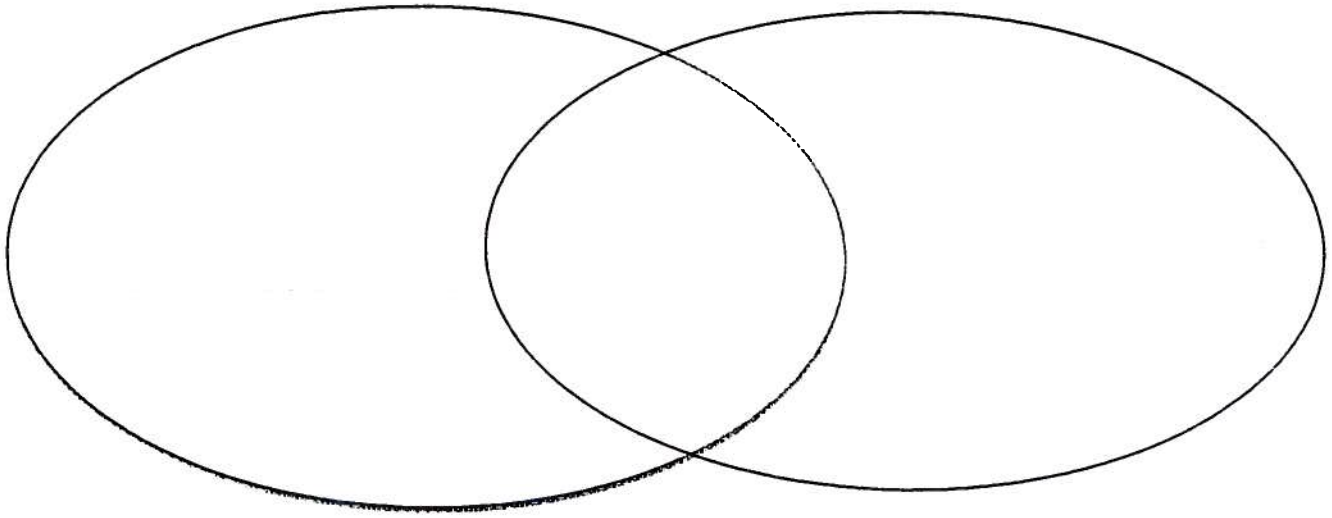
Unit 3: Periodic Table



MiIKs / MoNaCo

Compare and contrast Mendeleev's organization of the elements with Henry Mosely's in the Venn diagram provided:

Mendeleev **Moseley**



What is periodic law?

How is the modern periodic table arranged?

It's Elemental

DIRECTIONS: *Use the reading below to answer the questions that follow.*

We all know by now that the periodic table is arranged according to increasing atomic number. What we're only beginning to learn is the significance of elements within the same column (vertical) and row (horizontal) on the table.

Every element found within a given row, or ***period***, has the same number of electron shells, or ***principle energy levels***. Despite this one common feature, atoms of one element within a given period do not behave similar to atoms of another element in that same period. In fact, the period in which an element is found really tells you nothing about how the atoms of that element will behave. The only additional thing that we can really say about elements of the same period is that they increase by very little in terms of size (or mass) as we go from left to right on the table—remember, the atomic number, or number of protons only goes up by one. Take out the periodic tables that you labeled and color-coordinated. Look at how much the mass increases as you move from left to right in a given period.

Every element found within a given column, or group, has the same number of valence electrons. This is VERY significant because it's the number of valence electrons that determines how atoms of any element are going to "behave." When we say "behave," what we really mean is how they're going to react, or bond with atoms of other elements. However, not all columns or groups qualify as "families." In fact, the only groups that are considered to be families are Group I (Alkalai Metals), Group II (Alkaline Earth Metals), Group XVII (Halogens), and Group XVIII (Noble Gases). The behavior of, and the behavior of the elements within the BCNO group varies greatly from one element to another. An element's family tells you much more about its properties than its period does.

All of the elements in the Halogen family have 7 valence electrons. There's an easy way to cheat when it comes to determining the number of valence electrons. Just look at the last digit of the group number above the first element in the family. For the first two families (alkali metals and alkaline earth metals) it's a single digit number, so there's no confusion. Alkali metals are group 1, which means all elements in that family have 1 valence electron. The halogen family, on the other hand, is group 17, which means they have how many electrons in their valence shell? If you said 7, you're right. This trick will help you when it comes to drawing Lewis dot diagrams...

Speaking of the Lewis dot diagram, it's used to show only the ***valence*** electrons in a given atom or compound. After all, the valence electrons are the only electrons involved in ***bonding***. There are four basic spots that an electron can occupy in a Lewis dot diagram and by rule, the maximum number of valence electrons that an atom of an element can hold is eight. We refer to this as the ***octet rule***. The exceptions to the octet rule are elements that have only one energy level or seek to have one energy level. These elements include hydrogen, helium, lithium, beryllium, and boron. These elements also seek to have a full valence shell, but it will only contain two electrons.

All atoms seek to have a full valence shell, and the easiest way to do that is to form bonds with other atoms. We mentioned before that atoms in the family of noble gases already have a full valence shell, and that's why they rarely ever seek to bond with other atoms. For all other element families, the atoms seek to form bonds in order to complete their valence shell. As a general rule, the number of ***unpaired*** valence electrons tells you the number of bonds that atoms of a given element "like" to form. Halogens, like chlorine (Cl), have 7 valence electrons and only one unpaired valence electrons. That means that the halogens have two choices:

1. They can steal an electron from a metal, like sodium (Na), or a polyatomic ion. This ***transfer of electrons*** is what we call an ***ionic bond***.
2. The other choice an atom like chlorine has is to share an electron with an atom that's also one short of having a full valence shell, like another chlorine atom. This ***sharing of electrons*** is an example of a ***covalent bond***. As we said before, carbon has 4 valence electrons, which means that all of them can occupy a seat unpaired for a maximum of 4 unpaired valence electrons.

That's why carbon looks to share each of its 4 single valence electrons in order to end up with 4 ***pairs***, giving it the full 8 it needs to fill its valence shell. In other words, carbon will form 4 covalent bonds. A single line is used to illustrate a bond between two atoms, and each single line represents 2 electrons.

1. How is the periodic table arranged? (According to what?)

2. What do we call the horizontal rows of the periodic table? What do all the elements in a given row have in common?

3. What do we call the vertical columns of the periodic table? What do all the elements in a given column have in common?

4. Which tells us more about an element's properties, its row or its column? Why is this?

5. Chlorine's chemical properties are most similar to which of the following elements?
   a. fluorine (F)
   b. sulfur (S)
   c. oxygen (O)
   d. argon (Ar)

6. Are atoms of the elements in the family of noble gases reactive (do they readily form bonds with other atoms)? Why is this?

7. How are ionic bonds formed?

8. How are covalent bonds formed?

9. What determines how many bonds an atom will form?

_____

10. What is the easiest way for atoms without a full valence shell to gain a full valence shell?

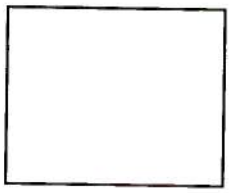
_____

11. If an atom of an element has four valence electrons, what is the maximum number of unpaired electrons it can have? Draw a Lewis Dot diagram of an element that fits this description.

_____

12. Draw a Lewis Dot diagram of an element with 6 valence electrons. How many bonds can it form?

_____



13. Why do chlorine (Cl) and sodium (Na) bond so easily with one another? (Hint: Draw Lewis dot diagrams of each element.)

_____

_____

14. Which element, carbon (C) or fluorine (F) would you expect to be more reactive? Explain your answer. (Hint: Think about which element is closer to its goal.)

_____

_____

PERIODIC TABLE – The Basics

1. The periodic table was ***originally*** arranged according to _____
2. Our current periodic table is arranged according to _____
3. The periodic table is essentially divided into two types or categories of elements.

   Those categories are _____ and _____
4. The dividing line between these two categories of elements is in the shape of a

   _____
5. The elements that border or touch this dividing line are referred to as

   _____
6. Explain why the elements from question #5 have this name:

   _____
7. The first period on the table in which we see transition metals is period _____
8. The transition metals represent a gradual transition or change from _____

   to _____
9. The ***most*** metallic elements on the periodic table are found in the

   a. upper right
   b. lower right
   c. upper left
   d. lower left
10. The ***least*** metallic elements on the periodic table are found in the

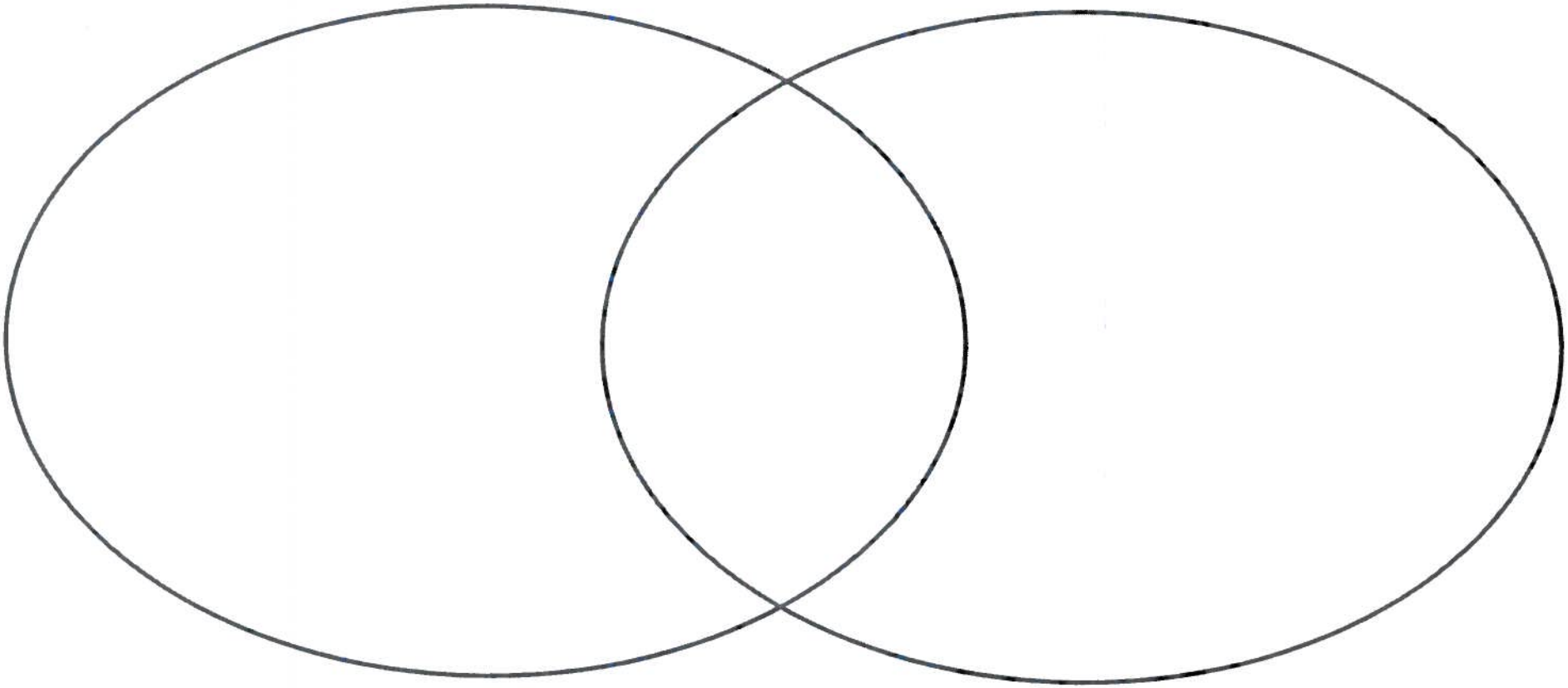
    a. upper right
    b. lower right
    c. upper left
    d. lower left
11. Which of the following is NOT a Group I metal?

    a. Hydrogen
    b. Lithium
    c. Sodium
    d. Potassium
12. Name the only four groups on the periodic table that qualify as families.

    _____

    _____

Comparing & Contrasting Metals and Nonmetals



How would you identify a sample of an element as a metal or a nonmetal? What tests would you do?

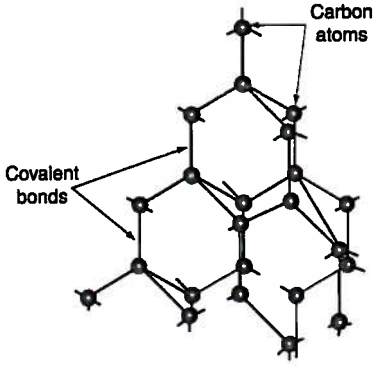
Allotropes

Allotrope is the name given to two different structural forms of the same element. For example, carbon can form very complex molecular structures like sheets, tubes, and long chains. Depending on how the carbon atoms are arranged, the molecule created will have radically different properties. Graphite and Diamond are two allotropes of Carbon. Diamond is made of 100% carbon atoms connected in a specific way, and as a result diamond is the hardest substance on Earth. Graphite is also made of 100% carbon atoms, but they are connected in a different way. As a result, graphite is actually one of the softest compounds on Earth. Two different arrangements of the same atoms result in incredibly different properties. Allotropes.

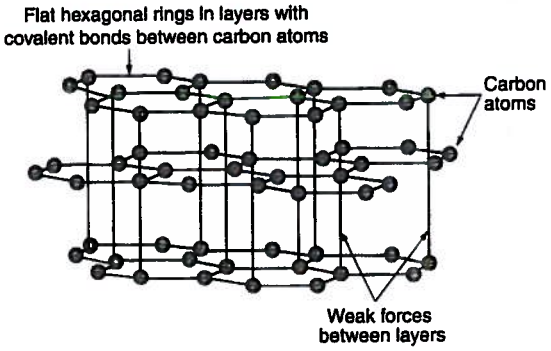
In diamond the carbon atoms are arranged in the shape of a tetrahedron, with one carbon atom in the centre of each tetrahedron and one at each point. Each carbon atom shares a pair of electrons with four other carbon atoms, forming a network or lattice structure. All of the carbon atoms throughout the network are bound together by strong covalent bonds.

In graphite, the carbon atoms are joined together in hexagonal shaped rings. Each atom shares a pair of electrons with three other atoms. Thus strong covalent bonds hold the carbon atoms together in the rings. Each ring is attracted to the ring above and below it by weak dispersion forces.

Diamond



Graphite



Physical property of diamond	Structure
Very hard.	Strong covalent bonds that extend throughout the lattice holding the atoms firmly together. A lot of energy is needed to break these bonds and allow the substance to change shape.
Poor conductor of electricity.	No ions present. Electrons are held in covalent bonds so they are not free to move.
High density.	Strong covalent bonds extend throughout the lattice holding the atoms closely packed together and hence diamond is dense.
High melting and boiling points.	Strong covalent bonds extend throughout the lattice. A lot of energy is needed to break these bonds and allow the substance to change state.
Brittle.	Can be fractured if hit along crystal plane.

Physical property of graphite	Structure
Softer than diamond, can write on paper and be used as a lubricant.	Weak dispersion forces between layers of carbon atoms are easily broken allowing a layer to be left on paper as writing or to form a smooth layer along a surface to act as a lubricant.
Good conductor of electricity.	Each carbon atom has 3 of its 4 outer shell electrons involved in covalent bonding with other atoms; the fourth electron of each atom is free to move.
Lower density than diamond.	Strong covalent bonds hold the tetrahedrons close together in diamond. Weak dispersion forces between the layers of carbon atoms in graphite do not hold the atoms as closely packed together.
Low melting and boiling points.	Weak dispersion forces between layers of carbon atoms are easily broken so change of state takes place more easily.

Allotropes of Carbon

1. Describe the arrangement of carbon atoms in:

   a) Diamond:_____

   b) Graphite: _____

2. Use diagrams to show the structure of graphite and diamond

Complete the table below to describe the physical properties of graphite and diamond and the structural features that account for them.

a) **Diamond**

Property	Description	Structure	Use
Hardness			
Melting point			
Boiling point			
Electrical conductivity			
Density			

a

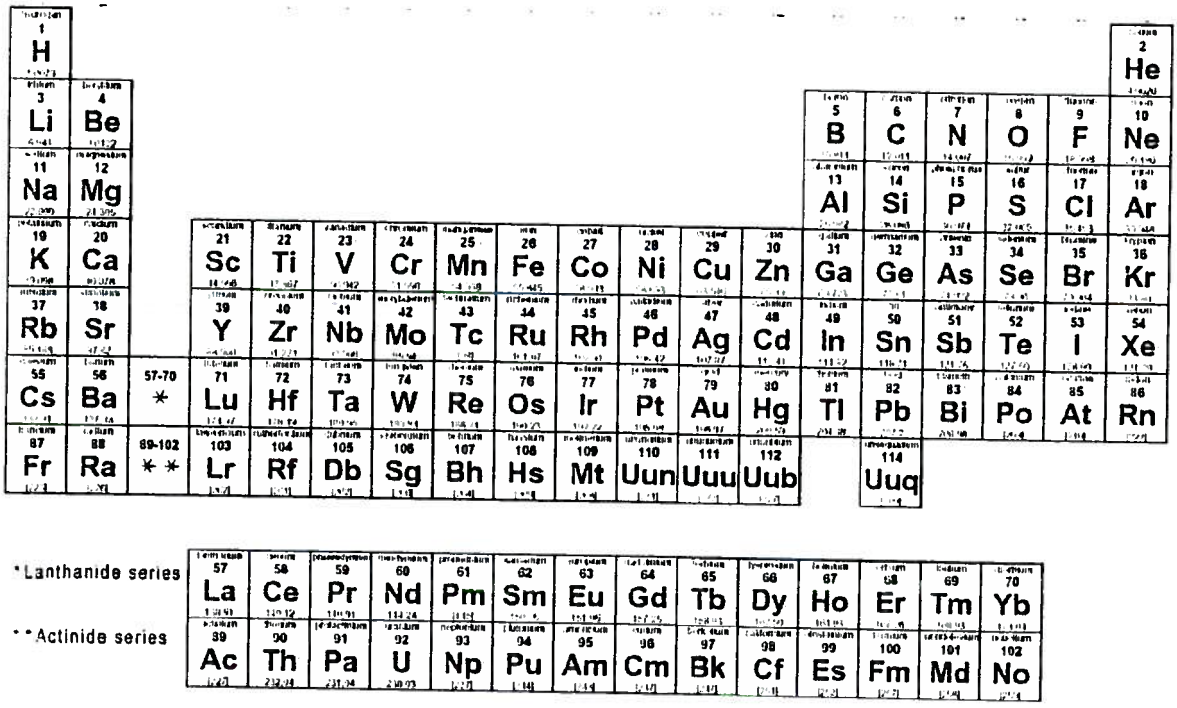
b) **Graphite**

Property	Description	Structure	Uses
Hardness			
Melting point			
Boiling point			
Electrical conductivity			
Density			

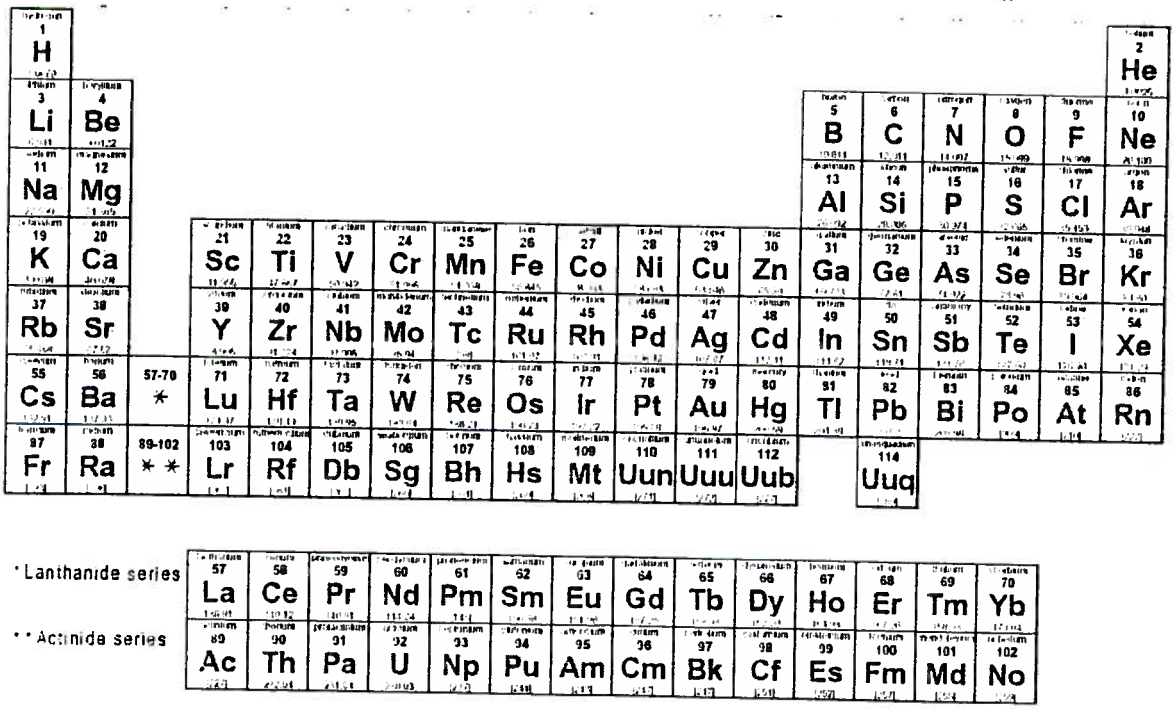
Periodic Table Coloring Assignment

Directions: Using crayons or colored pencils, color the following periodic tables according to the directions below and answer the following questions. All work should be done on this page.

1. On the periodic table below, color the metals blue, the semi-metals purple and the non-metals red.



2. On the periodic table below, color the elements according to the phase they are at standard temperature. Color the liquids green, the gases red, and the solids brown.



3. Three mysterious elements are found in a lab. Sample A has a very dull appearance and breaks apart when hit with a hammer. Sample B has a shiny appearance and breaks apart when hit with a hammer. Sample C has a shiny appearance when it's polished with a cloth and is easily bend by your hands. What kind of element is each sample? Explain your answer.

4. After further experimentation you find out that all there samples have similar chemical properties. You know that none of the samples can be bismuth (Bi) or polonium (Po) because they are too dangerous for your teacher to allow in the laboratory. What group of the periodic table must the samples be from? Explain your answer.

5. What do the periods of the periodic table have in common?

6. What do the groups of the periodic table have in common?

7. Describe Henry Mosely's contribution to the arrangement of the periodic table.

8. List three properties of metals:

   a. _____

   b. _____

   c. _____

9. List three properties of nonmetals:

   a. _____

   b. _____

   c. _____

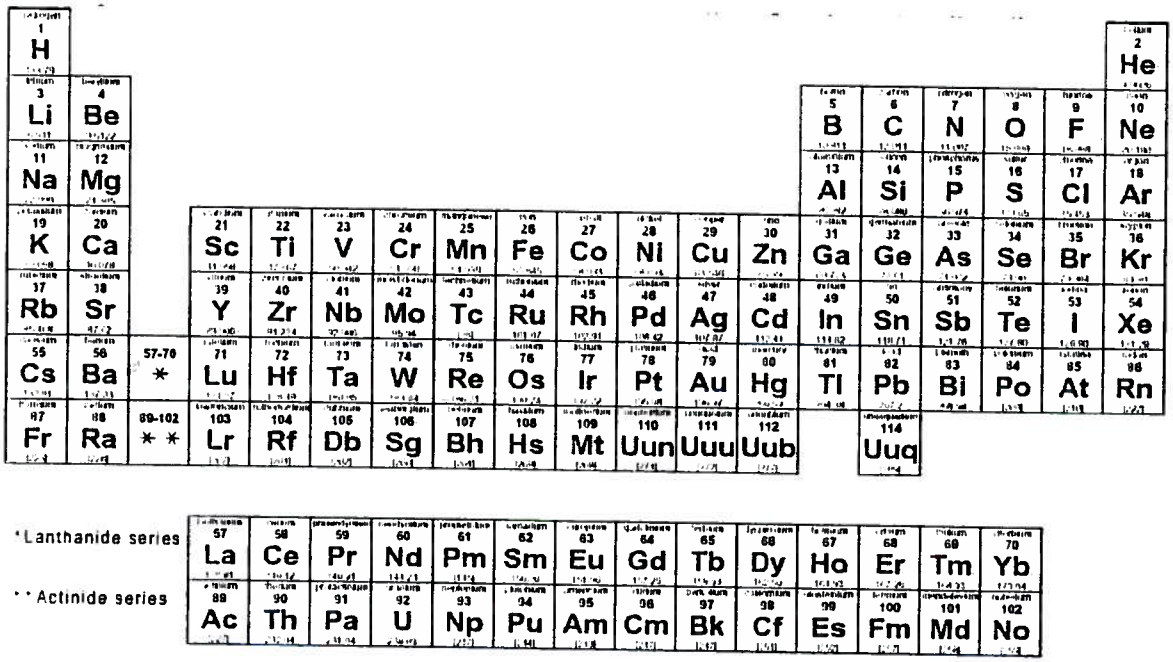
10. Does metallic character increase or decrease as you go across a period from left to right?

11. Define the words malleable and ductile.

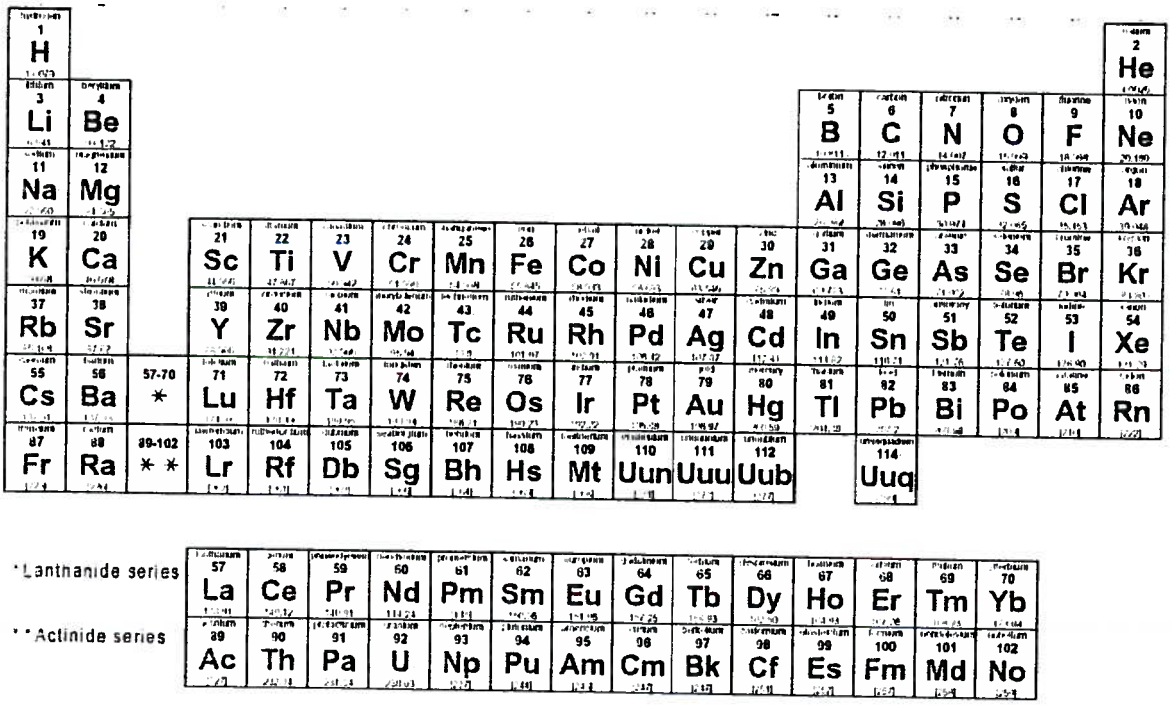
12. Define the term allotrope.

Periodic Table Coloring Assignment #2

Directions: Using crayons or colored pencils, color the following periodic table according to the directions below and answer the questions. All work should be done on this page.



1. On the periodic table above, color the **Diatomic Elements** a bright color.



2. On the periodic table above, color the elements according to the family or group they are in. Color in the key below to show which colors represent each family.

Alkali Metals ☐
Alkaline Earth Metals ☐
Transition Metals ☐
BCNO Group ☐
Halogens ☐
Noble Gases ☐
Lanthanoid ☐
Actinoid ☐

3. Use the following list of elements as a word bank to answer the questions below. Each element may be used more than once or not at all.

Fluorine	Magnesium	Silicon	Sulfur	Iron	Cesium	Radon

A. Which one is a halogen?

B. Which one is an alkaline earth metal?

C. Wjich one is a noble gas?

D. Which one has the largest atomic radius?

E. Which one forms colored ions when in a solution?

F. Which one has the highest attraction for electrons?

G. Which one will have properties of both metals and nonmetals?

H. Which one is an alkali metal?

I. Which one is a transition metal?

J. Which one has the lowest metallic character?

K. Which one has the greatest metallic character?

L. Which three are most likely to flatten when hit with a hammer?

M. Which one requires the most amount of energy to remove an electron?

N. Which three are most likely to be poor conductors?

O. Which one is an unreactive gas?

PERIODIC TRENDS #1

1) Why is it difficult to measure the size of an atom?

2) What does the term atomic radius mean?

3) What is ionization energy?

4) What periodic trends exist for ionization energy?

What exceptions exist in this trend?

5) What trend is evident in atomic radius as you proceed down a group of elements?

How does this trend progress as you move across a period?

6) Define the term electron shielding.

7) What effect does electron shielding have on atomic radius? On ionization energy?

8) When an atom loses an electron, what is its charge? What do you think happens to the atomic radius of the atom?

9) When an atom gains an electron, what is its charge? What do you think happens to its atomic radius?

10) What metal in period 6 has the lowest melting point? The lowest boiling point?

PERIODIC TRENDS #2

1. Compare metals and non metals according to the following properties:
   - 1st Ionization energies

     _____

   - Electronegativities

     _____

   - Phase at STP

     _____

   - Malleability, ductility, brittleness

     _____

   - Conductivity; heat and electricity

     _____

   - Luster

     _____

2. Compare the radius of a metal atom with the radius of its ion. (Ex: Na vs. Na^{+1})

   _____

3. Compare the radius of a nonmetal atom with the radius of its ion. (Ex: Cl vs. Cl^{-1})

   _____

4. What is true of all elements in a group? What do they have in common, what are some trends?

   _____

   _____

5. What is true of all elements in a period? What do they have in common, what are some trends?

   _____

   _____

6. Why is sulfur less reactive than oxygen?

   _____

7. Why is sodium more reactive than lithium?

   _____

PERIODIC TRENDS #3

1) Which atom in each pair has the larger atomic radius? Circle the correct one for each.

   a) Li or Rb

   b) Ca or K

   c) B or Al

   d) Al or P

   e) C or Br

   f) Po or Se

2) How does one measure the atomic radius of an atom?

_____

3) Why do atoms get smaller as you move across a period?

_____

4) Explain why the atomic radius will increase as you go down a group.

_____

5) Which atom in each pair has the larger ionization energy? Circle the correct one.

   a) C or B

   b) Li or K

   c) C or F

   d) Ca or Cs

   e) O or S

   f) Na or Cl

6) What effect does the nuclear charge of an atom have on the ionization energy?

_____

7) Explain why potassium, with a larger nuclear charge (more protons in the nucleus), still has a lower ionization energy than lithium.

_____

PERIODIC TRENDS #4

Which atom in each pair has the larger atomic radius?

1) Li or K

2) Ca or Ni

3) Ga or B

4) O or C

5) Cl or Br

6) Be or Ba

7) Si or S

8) Fe or Au

Which ion in each pair has the smaller ionic radius?

9) K^+ or O^{2-}

10) Ba^{2+} or I^-

11) Al^{3+} or P^{3-}

12) K^+ or Cs^+

13) Fe^{2+} or Fe^{3+}

14) F^- or S^{2-}

15) Define ionization energy.

Which atom in each pair has the larger ionization energy?

16) Na or O

17) Be or Ba

18) Ar or F

19) Cu or Ra

20) I or Ne

21) K or V

22) Ca or Fr

23) W or Se

Write the charge that each of the following atoms will acquire when it has a complete set of valence electrons (when it becomes its appropriate ion).

24) O

25) Na

26) F

27) N

28) Ca

29) Ar

30) Define atomic radius.

_____

31) Why do atoms get smaller as you move across a period.

_____

32) Explain the relationship between the realative size of an ion to its atom and the charge on the ion.

_____

_____

33) Explain why noble gases are inert and do not form bonds or ions.

_____

34) Define the term electronegativity.

_____

35) What is the trend for electronegativity as you go down a group?

_____

36) What is the trend for electronegativity as you go across a period (left to right)?

_____

37) Which of the following within each pair has the greatest electronegativity?

a. Li or K
b. Na or O
c. Be or Ba
d. Ne or F
e. S or Se
f. Ca or Mg

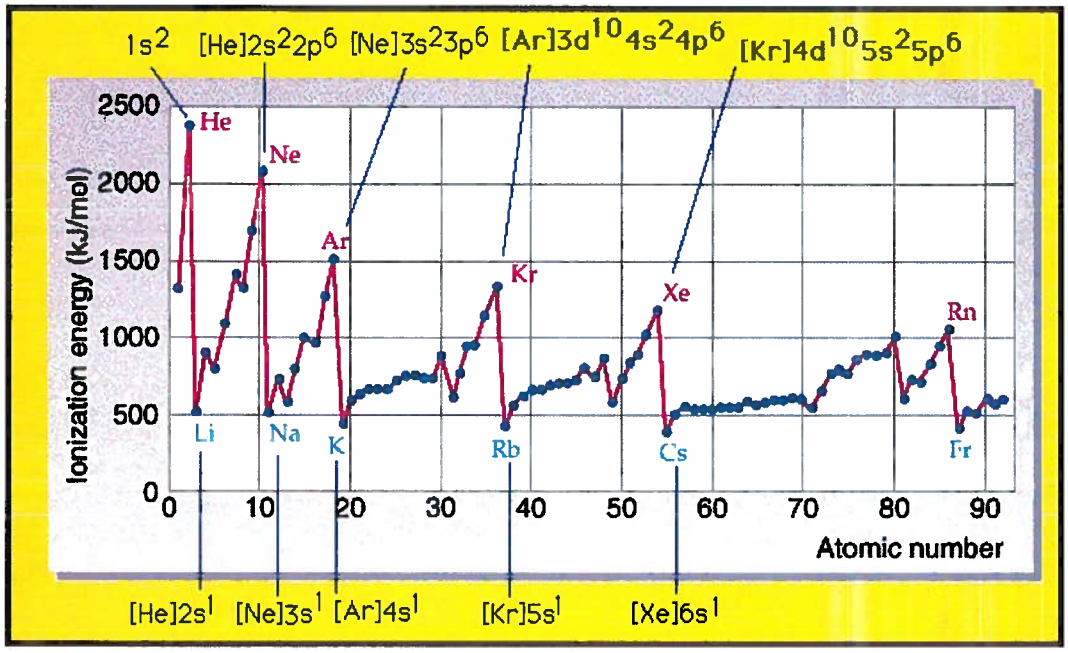
PERIODIC TRENDS #4

1. What happens to ionization energy as you move across a period (from left to right)? _____
2. Explain your answer to #1 in terms of nuclear charge and shielding.

   _____
3. What happens to ionization energy as you move down a group?

   _____
4. Explain your answer to #3 in terms of nuclear charge and shielding.

   _____
5. Look at the chart below. Elements from which group or family represent each of the peaks along the curve? _____



6. Explain this trend of "peaks and valleys" for ionization energy in terms of both nuclear charge and shielding.

   _____

   _____

   _____

   _____
7. What happens to electronegativity as you move across a period (from left to right)? _____

   _____
8. Explain in terms of shielding and nuclear charge.

   _____

9. What happens to electronegativity as you move down a group?

10. Explain in terms of shielding and nuclear charge.

11. What happens to the reactivity of metals as you move across a period?

12. Explain in terms of shielding and nuclear charge.

13. What happens to the reactivity of metals as you move down a group?

14. Explain in terms of shielding and nuclear charge.

15. What happens to the reactivity of nonmetals as you move across a period?

16. Explain in terms of shielding and nuclear charge.

17. What happens to the reactivity of nonmetals as you move down a group?

18. Explain in terms of shielding and nuclear charge.

Lewis Dot Diagrams

DIRECTIONS: Use your periodic tables to help you draw the Lewis dot diagrams for the following elements as well as the number of bonds it can form and the group number.

1. Cl — Number of bonds: **1** — Group #: **17**

2. N — Number of bonds: **3** — Group #: **15**

3. He — Number of bonds: **0** — Group #: **18**

4. C — Number of bonds: **4** — Group #: **14**

5. Na — Number of bonds: **1** — Group #: **1**

6. Mg — Number of bonds: **2** — Group #: **2**

7. F — Number of bonds: **1** — Group #: **17**

8. Ne — Number of bonds: **0** — Group #: **18**

9. H — Number of bonds: **1** — Group #: **1**

10. As — Number of bonds: **3** — Group #: **15**

11. Al — Number of bonds: 3 — Group #: 13

12. Ca — Number of bonds: 2 — Group #: 2

13. Kr — Number of bonds: 0 — Group #: 18

14. P — Number of bonds: 3 — Group #: 15

15. B — Number of bonds: 3 — Group #: 13

16. I — Number of bonds: 1 — Group #: 17

17. Be — Number of bonds: 2 — Group #: 2

18. Ga — Number of bonds: 3 — Group #: 13

19. Rb — Number of bonds: 1 — Group #: 1

20. O — Number of bonds: 2 — Group #: 16

Directions: Use the word bank below to fill in the blanks in the passage that follows.

Actinide series	Group	Nonmetal
Alkali metal	Halogen	Period
Alkaline earth metal	Lanthanide series	Periodic law
Atomic mass	Metal	Periodic table
Atomic number	Metalloid	Transition element
Family	Noble gas	

Dmitri Mendeleev developed a chart-like arrangement of the elements called the _____. He arranged the elements in order of increasing _____, but what he discovered were many gaps. The chart was not that organized and easy to use. The arrangement used today differs from that of Mendeleev in that Henry Mosely arranged the elements in order of increasing _____. He called this the _____ of the elements. Each horizontal row of elements is called a(n) _____. Each vertical column is called a(n) _____, or because of the resemblance between elements in the same column, a(n) _____.

In rows 4 through 7, there is a wide central section containing elements, each of which is called a(n) _____. Rows 6 and 7 also contain two other sets of elements that are listed below the main chart. These are called the _____ and the _____ respectively. In Group 13 between boron and aluminum, there is a "staircase." All elements to the left of that staircase are _____, and all elements to the right of that staircase are _____. All of the elements touching the staircase (except Al) have some but not all of the properties of metals, and are called _____.

Each of the elements in Group 1 is called a(n) _____
Each of the elements in Group 2 is called a(n) _____
Each of the elements in Group 17 is called a(n) _____
Each of the elements in Group 18 is called a(n) _____

Reactivity and Ionic Radius

1. When metals react what occurs in terms of their valence electrons?

_____

2. How does a metal's atomic radius vary from its ionic radius? Explain this difference.

_____

_____

_____

3. Predict which of the following metals are most reactive:
   a. Na or Mg
   b. Mg or Ra
   c. Ti r Cu
   d. Cu or Fr

4. How does a nonmetal's atomic radius vary from its ionic radius? Explain this difference.

_____

_____

_____

5. Predict which of the following nonmetals are least reactive:
   a. N or O
   b. S or O
   c. Cl or F
   d. P or S

6. Why are noble gases considered inert?

_____

_____

REVIEW of the PERIODIC TRENDS

1. Describe the trend for atomic radius as you go across a Period.

2. What is an explanation for this trend?

3. Describe the trend for atomic radius as you go down a group.

4. What is an explanation for this trend?

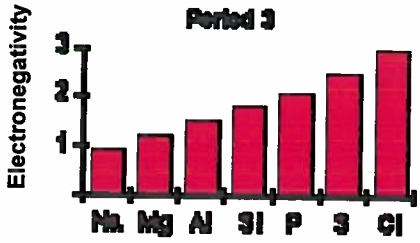
5. Describe the trend for the 1st ionization energy as you go across a period.

6. What is an explanation for this trend?

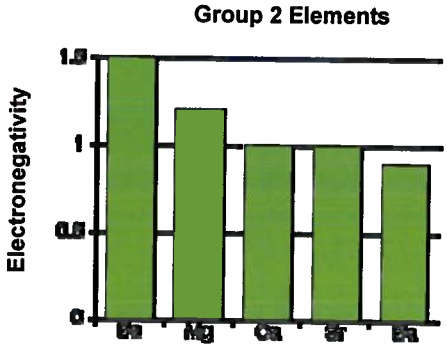
7. Describe the trend for the 1st ionization energy as you go down a group.

8. What is an explanation for this trend?

9. Describe the trend illustrated by the graph below and explain why it occurs.



10. Describe the trend illustrated by the graph below and explain why it occurs.



11. Describe the trend for metallic character/reactivity as you go across a period.

12. What is an explanation for this trend?

13. Describe the trend for metallic character/reactivity as you go down a group.

14. What is an explanation for this trend?

15. Describe the trend for reactivity of nonmetals as you go across a period.

16. What is an explanation for this trend?

17. Describe the trend for reactivity of nonmetals as you go down a group.

18. What is an explanation for this trend?

The Periodic Table

Directions: Fill in the blanks using the word bank below. Each word is used only once.

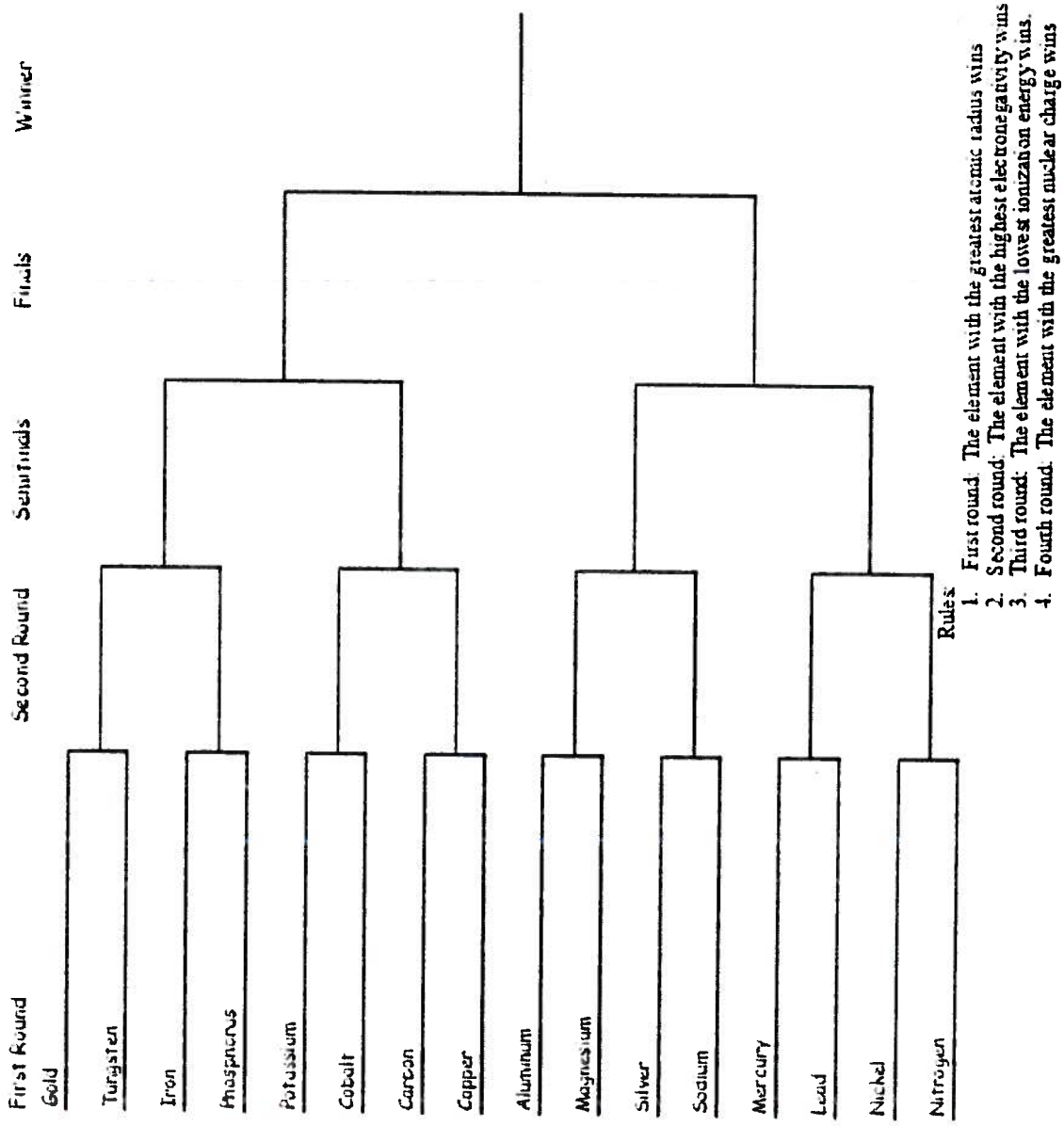
Actinide Series	*Group*	*Nonmetal*	*Alkali metal*
Halogen	*Period*	*Alkaline Earth Metal*	*Lanthanide Series*
Periodic Law	*Atomic mass*	*Metal*	*Periodic Table*
Atomic Number	*Metalloid*	*Transition Element*	*Family*
Noble Gas			

Dmitri Mendeleev developed a chart-like arrangement of the elements called the _____. He stated that if the elements were listed in order of increasing _____, their properties repeated in a regular manner. He called this the _____ of the elements. The arrangement used today differs from that of Mendeleev in that the elements are arranged in order of increasing _____. Each horizontal row of elements I called a(n) _____.

In rows 4 through 7, there is a wide central section containing elements, each of which is called a(n) _____. Rows 6 and 7 also contain two other sets of elements that are listed below the main chart. These are called the _____ and _____ respectively. Each of these elements, as well as those in the first two columns at the left end of the chart, is classified as a(n) _____. Each of the elements between these two main types, having some properties like one type and other properties like the other type, is called a(n) _____.

Each element in Group 1 is called a(n) _____.
Each element in Group 2 is called a(n) _____.
Each element in Group 17 is called a(n) _____.
Each element in Group 18 is called a(n) _____.

Sweet 16 Periodic Table Tournament



Periodic Table Review Topics

- The 7 diatomic elements: H, N, O, F, Cl, Br, I ("Horses Need Oats For Clear Brown I's")
- Elements that are solid, liquid and gas at STP
  - 2 liquids: Br and Hg
  - Gases: H, N, O, F, Cl & Noble Gases
  - All other elements are solid @ STP
- Location of metals, nonmetals, and metalloids (semi-metals) on periodic table
  - Metals are left of the stair-stepped line (most elements)
  - Nonmetals are right of the stair-stepped line
  - Metalloids are touching a line on the stair-stepped line (Al is an exception)
- Periods are rows
- Groups are columns
- Metallic Character
  - Elements farthest left and farthest down have most metallic character
  - Luster, conductivity, malleable, ductile
- Nonmetallic character
  - No or little luster, poor conductors, brittle
  - Semi-metals possess some characteristics of both metals & nonmetals
- Trends:
  - Atomic radius – ½ distance between nucleus of two atoms bonded together (distance between nucleus and valence electron shell.
    - Increase as move down group
      - More principle energy levels (electron shells)
    - Decrease as move left to right across period
      - More protons = greater nuclear charge pulling the electrons toward center
  - Ionization energy – amount of energy needed to pull valence electron away from atom
    - Decrease as move down a group
      - As radius increases, valence electrons are farther from nucleus.
    - Increases as move left to right across period
      - As radius decreases, valence electrons are closer to nucleus & greater nuclear charge makes attraction for electrons greater
  - Electronegativity – ability to attract electrons in a chemical bond
    - Decreases as move down a group
      - As radius increases, electrons are farther from nucleus
    - Increases as move left to right across a period
      - As radius decreases and as nuclear charge increases attraction for valence electrons increases
- Reactivity
  - Metals
    - Most reactive = elements that lose electrons easily
    - More reactive as move down groups and move left across a period
    - Most reactive metal is Francium
  - Nonmetals
    - Most reactive = elements that gain electrons easily
    - Less reactive as move down group and move left across period
    - Noble gases are inert (non-reactive) because they already have a full octet (full valence shell of 8 e^-)

- Ionic radius vs. Atomic radius
  - Metals
    - Atomic radius is larger than ionic radius
    - Metals lose electrons and lose valence shell
  - Nonmetals
    - Atomic radius is smaller than ionic radius
    - Nonmetals gain electrons, more electrons in outer shell makes it larger
- Mendeleev
  - Father of periodic table
  - Organized elements based on mass
  - Predicted properties of elements that had not yet been discovered
- Mosely
  - Organized periodic table based on atomic number
  - Mirrors todays organization of periodic table
- Periodic law
  - Properties repeat themselves every 8 elements
- Families:
  - Alkali Metals
    - Most reactive group of metals (group 1)
    - Have one valence electron
    - Tend to lose valence electron and form +1 ions
    - Found in nature bonded to other elements as compounds
  - Alkaline Earth Metals (group 2)
    - Almost as reactive as alkali metals
    - Have two valence electrons
    - Tend to lose both valence electrons to form +2 ions
    - Found in nature bonded to other elements as compounds
  - Transition Metals (groups 3- 12; d-block)
    - Largest family
    - Form colored ions when mixed with water
  - BCNO group (Groups 13-16)
    - Most diverse family of elements
    - Contains metals, nonmetals and metalloids
  - Halogens (group 17)
    - Possess 7 valence electrons
    - Tend to gain 1 electron to form ions with -1 charge
    - Most reactive nonmetals
  - Noble Gases (group 18)
    - Least reactive elements/stable
    - Possess 8 valence electrons