Science - - PHYSICAL SCIENCE GRADE 9

Unit 2: CHEMISTRY – PART I (4.5 WEEKS)

SYNOPSIS: Students will learn to distinguish between physical and chemical properties. They will identify the basic structure of the atom and locate the individual parts. They will compare and contrast ionic and covalent bonds; draw Lewis dot diagrams; and successfully name compounds formed by both ionic and covalent bonds. Students will also use the periodic table to predict the forming of bonds between different atoms.

STANDARDS

I. The Study of Matter

A. Classification of Matter

2. Properties of matter are physical and chemical.
   b. chemical properties are mainly about reactivity
3. Changes in states of matter involve temperature and the absorption and release of energy.
   b. phase changes are examples of changes that can occur when energy is absorbed from the surroundings (endothermic) or released into the surroundings (exothermic)

B. Atoms

2. Ions (cations and anions) are among the signature structures associated with atoms.
   a. atoms may gain or lose electrons to become anions or cations
   b. atomic number, mass number, charge, and identity of the element can be determined from the number of protons, neutrons, and electrons
   c. each element has a unique atomic spectrum that can be observed and used to identify it
3. Isotopes are the variations in the atom of an element due to different numbers of neutrons; all atoms of a particular element have the same atomic number, but the isotopes of an element have different mass numbers.

C. Periodic Trends of the Elements

1. In Periodic Law, atoms are listed in order of increasing atomic number; the sequence of properties repeat.
2. The elements are clustered into "periods" and "families."
   a. elements are identified by their horizontal position on the Periodic Table as "periods:" metals, nonmetals, and metalloids
   b. elements are identified by their vertical position on the Periodic Table as "families:" alkali metals, alkaline earth metals, halogens, and noble gases
   c. in a "family," elements have similar chemical and physical properties; metalloids have some properties of metals and some of nonmetals
   d. elements in groups 1, 2, and 17 have characteristic ionic charges that are used to predict formulas of compounds

D. Bonding and Compounds

1. Bonding (ionic and covalent) is the formation of molecules by gaining, losing, or sharing electrons.
   a. an ionic bond is the attraction of two oppositely charge ions, typically a metal cation and a nonmetal anion; they are formed by transfer of electrons between atoms; ions attract oppositely charged ions from every direction, forming a 3-D lattice
   b. covalent bond is the sharing electrons between two atoms - - usually nonmetals; structures formed range from small individual molecules to 3-D lattices (e.g., a diamond)
2. Formulas for predicting ionic compounds use ionic charge (groups 1, 2, 17, H, O).
3. The ionic and covalent names of substances are used in writing formulas.
4. Given a chemical formula, the nomenclature (or how to name compounds), uses Prefixes and Suffixes.

E. Reactions of Matter

1 Chemical reactions are about changes in the electrons.
   b. reactions are endothermic or exothermic
   c. there are signs a chemical reaction has occurred, but since the environment surrounding the system can be large, changes in temperature may not be detectable

LITERACY STANDARDS: READING (RST) and WRITING (WHST)

VOCABULARY: Post words in room and leave up for the unit. Create a word wall where students know to look for new words.

Address roots and affixes of new words
Use a diagram to show meaning of new words
Relate the new word to a similar and/or familiar word
In the course of teaching, define the word in the context of where if falls in the unit rather than in isolation
Throughout the teaching of the unit, use the word in conversation/discussion
Require students to use the word(s) in: discussion, investigations, and in 2-and 4-point response questions
Use new words in Rubric for the Authentic Assessments

MOTIVATION	TEACHER NOTES
1. "Atom joke" why words positive and negative are used by the talking atoms; "I've lost an electron!" "Are you sure?" "Yes, I'm positive." 2. Teacher reviews that matter is made of atoms - - reference the Bill Nye video from Matter Unit 2 3. Refer to the labs done in Unit 1 - - different materials at different temperatures; have students relate experiences they had to connect to the standards for this unit. 4. Tell students that some of the things done in Unit 1 will connect to key concepts in this unit: **endothermic** and **exothermic**. Have students look at these words and try to determine what they might mean using the following strategies: a. What do the prefixes and suffixes tell us about the words? b. What might the root word mean? c. Give sentences with the words in them and have students try to determine the meaning from context. (e.g., by nature, warm-blooded animals are endothermic. The burning of fuels is an exothermic process). 5. Let students know that they will be continuing to work with boiling, conservation of energy, melting points, physical and chemical properties, kinetic energy, etc. 6. Students establish both academic and personal goals for this unit 7. Teacher previews the Authentic Assessments for the end of the Unit	

TEACHING-LEARNING	TEACHER NOTES
1. Teacher does demo to have students determine if what they are seeing shows chemical or physical properties - - e.g., pencil - - how it can be changed and still be a pencil (physical); what if it is burned (chemical); focus on what changes and reactivity. Pose the question if you mix salt and sand - - how can you separate them (ans. add water, filter the mixture and let the water evaporate) Students answer questions about the **salt-sand-water demo** (**Page 6**). Address why this concept is important in real-life and give students three examples **(IA2b)** • How to get snow off road (push it with a plow – physical; use salt – physical • Sprain wrist or ankle - - using ice cools the ankle to reduce blood flow – physical; or you can use a chemical reaction ice pack – chemical • Chewing food – physical; digesting food – chemical • Cut down a tree and chop it up – physical; burning wood in a fireplace – chemical 2. Teacher uses hand warmers and ice pack as a way to introduce **endothermic and exothermic (**text page 175) (refer to what they did in Motivation activity with the words. Then pass around several hand warmers and ice packs and have students record the differences they feel when holding each	

TEACHING-LEARNING	TEACHER NOTES

of the items. From here, discuss salt on winter roads and show salt on ice cubes for students to get the idea that salt lowers the freezing point - - instead of ice forming at 32 degrees, it forms at 28 degrees. Next, show how salt added to a cup of water on a hot plate actually raises the boiling point. Normally, water boils at 100 °C, but with salt, it boils at a higher temperature.

Teacher offers other examples so students can connect to something in their lives - - Text book, page 22 poses the idea of drops of water on the bathroom mirror after a shower. Water from the shower changes to water vapor (phase change); then warm water vapor hits the cool mirror, it changes back to water (phase change). Other examples might include things like melting gold jewelry to make other things; dry ice changes from solid to gas – no liquid; if you pour water on dry ice, it forms fog (phase change). Have students give other examples in small group (e.g., opening a can of pop after dropping it, humidity, melting chocolate, new T.V's. (more examples: burning a candle is both physical (melting wax) and physical (burning), boiling water, making ice, drying hair with a hair dryer, able to see your breath on a cold day, melting butter, making grilled cheese, puddle of water or gasoline evaporating)**(IA3b) (IE1b,c)**

3. Give students a droplet of water on a slide and ask them how they think they could break it down; ask them what tools might be needed to accomplish this. Ask students: "What is water made of?" "How can you separate water down into atoms?" Teacher reviews the structure of the atom with **protons, neutrons, and electrons** by having students answer questions; students draw model to show structure. Students are guided to determine that to break it down into hydrogen and oxygen, you can't do it with tools, but by a chemical reaction. **(IB2b)**

   Teacher introduces **atomic number**, **mass number**, **ions**, and **isotopes**. Teacher shows that protons + neutrons = mass number. Pages 56-61 in text on mass number could also be read by students as there are pictures to illustrate this. **Isotopes worksheet attached on page 7**

   As the teacher works with the model of the atom, use different colors of (e.g., post-its, magnets, cardboard) to model electrons, protons, and neutrons. Have students do this as well, so they experience how the atom is structured. As the teacher does this, show how protons are equal to the number electrons and this is the **atomic number**. If we add or subtract neutrons to the nucleus, we change the **mass number**. **(IB3)**

   Give students atoms where the protons and electrons are not equal to lead into **ions**. Ask students what would happen if there were more protons than electrons - - they need to realize that electrons can be added or subtracted - - teacher does this with models. Use the following video to model how electrons form ions by adding or subtracting electrons.
   http://www.youtube.com/watch?v=zbFh8oZAfA0

   Teacher discusses "shells" and the number of electrons in each. Use carbon to do **the atomic number, mass number, ions and isotopes**. Discuss ions are the gaining or losing of electrons –- **cations** (more protons than electrons) and **anions** (gaining electrons; more electrons than protons). Give students reasons why isotopes are used today in medicine, industry, agriculture in developing hybrids, etc. Have students complete the **Isotopes Worksheet on page 6- of unit plan.** Some common uses of isotopes and radioisotopes include smoke detectors, food irradiation to slow spoiling, pest control, archeological dating, medical diagnosis, cancer treatment, trace movements of contaminants in soil and water, development of disease resistant plants, weapons, etc**. (IB2a)**

4. Teacher uses video to introduce **atomic spectrum**; explain that every element has its own spectral lines (e.g., fireworks, CSI investigations). **(IB2c)**

TEACHING-LEARNING	TEACHER NOTES
5. Teacher outlines how we got **to Periodic Law and the Periodic Table**; give information about the structure of the periodic Table, including **(IC1, IC2a,b,c,d)** ➢ Families / groups ➢ Periods / series ➢ Number and letter system for labeling Family names ➢ Metals, Non-Metals, and Metalloids ➢ Trends Students process information by using a blank period table to label Family names and periods (**attached on page 8 of unit plan**); explain that the elements are ordered according to their **atomic numbers**, based on **protons**. Text page 480 has Periodic Table. Group 1 has 1 electron in outer most shell; Group 2 has 2…; Group 13 has 3…; Group 14 has 4…; Group 15 has 5…; Group 16 has 6…; Group 17 has 7…; Group 18 has 8 or a full shell… (**Pages 9-15 of Unit Plan**) **(IC2)** Students read articles and search websites for information on Periodic Table to find out why elements are placed where they are: **Metals, Non-Metals, and Metalloids**. Teacher explains that in Families, elements have similar physical and chemical properties. There are 7 different articles on this website that are easy reads for students: http://science.howstuffworks.com/periodic-table2.htm **(IC2a,b,c)** Teacher then introduces placement of the Families: **alkali metals (Group 1), alkaline earth metals (Group2), halogens (Group 17), and noble gases (Group 18)**. Show elements in groups 1, 2, and 17 and relate to common every day products so students make connection to something real. Point out that elements in Group 18 do not react with other elements under ordinary chemical means. **(IC2b)** 6. **Bonding**: Revisit the location of electrons in the atom. Review what occurs when an atom gains or loses an electron. Page 63 of text has electron dot diagram activity. Draw examples of atoms becoming ions using Lewis dot diagrams. Have students copy the examples into their notes. Give students 3 or 4 examples of atoms and have them complete Lewis dot diagrams into their notes. Teacher will go over the correct answers and make sure students have correct diagrams in their notes. **(ID1a, b)** 7. Teacher discusses the concept **of ionic bonding** as it relates to valence electrons. Explain the atoms desire to fill, empty, or gather 8 electrons in its outer (valence) orbital. Show students the pattern of outer shell electrons in families of atoms. Atoms in group 1 have 1 valence electron. Atoms in group 2 have 2 valence electrons. Show the remaining patterns for families 13 through 18. **(ID1)** 8. **Ionic Bonds** involve a Metal with Non-Metal and the transfer of electrons. Draw several Lewis dot diagrams of atoms forming ionic bonds. Have students copy the drawings into their notes. Assign 2 or 3 atom pairs and have students draw the Lewis dot diagram of the ionic bond that would form. (hydrogen and chlorine, potassium and bromine, magnesium and iodine) Check students work. Remind students that ionic bonding involves transferring of valence electrons. **(ID1a)** 9. **Covalent Bonds** involve 2 or more Non-Metals and electrons are shared. Draw several Lewis dot diagrams showing the formation of chemical bonds by sharing valence electrons. (hydrogen and oxygen, sulfur and oxygen, etc.) Remind students covalent bonding involves sharing of valence electrons. **(ID1b)** 10. Have students compare and contrast both types of bonding. They may use Venn diagrams or other means.	

TEACHING-LEARNING	TEACHER NOTES
11. Give students several examples of compounds and identify the proper use of **prefixes** and **suffixes** to name the compounds. (e.g., CCl_4 is carbon **tetra**chlor**ide**, SO_2 is sulfur **di**ox**ide**, etc.) Show students examples of other suffixes, but let them know that this will not be addressed here, but later in Chemistry (-ate, and –ite). **(ID4)** 12. Have students practice naming compounds and writing formulas of **ionic and covalent bonds**. Stress the use of the atoms position on the periodic table to help in writing the formulas. Make sure to eliminate any misconceptions the students may have. Follow with a discussion or share/pair to check the student's work. **(ID3)**	

TRADITIONAL ASSESSMENT	TEACHER NOTES
1. Multiple-Choice **Unit Test**	

TEACHER CLASSROOM ASSESSMENT	TEACHER NOTES
1. Teacher Classroom Assessments	

AUTHENTIC ASSESSMENT	TEACHER NOTES
1. Students evaluate progress on their goals 2. Each student will compose and draw a cartoon book of at least 4 pages on the kinetic-molecular theory. The book must accurately reflect the kinetic-molecular theory, feature at least 3 colors, and be one story for four pages or a separate story in each cartoon	

Authentic Assessment Rubric

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CONTENT OF PROJECT	1	2	3	4
Cartoon Book of 4 Pages on the Kinetic-Molecular Theory	Created a single page cartoon on the Kinetic-Molecular Theory	Created two-page cartoon book on the Kinetic-Molecular Theory	Created three-page cartoon book on the Kinetic-Molecular Theory	Created four-page cartoon book on the Kinetic-Molecular Theory
Features at least 3 colors	Featured only one color in the cartoon book	Featured two colors in the cartoon book	Featured two colors in the cartoon book	Featured three colors in the cartoon book
Cartoon(s) reflects story	There is no story in the cartoon(s)	The story is incomplete in the cartoon(s)	NA	The story is complete in the cartoon(s)
This next element carries a more weight	**2**	**4**	**6**	**8**
Accurately reflects the Kinetic-Molecular Theory	Has many errors in showing the Kinetic-Molecular Theory **(2)**	Has several errors in showing the Kinetic-Molecular Theory **(4)**	Has few errors in showing the Kinetic-Molecular Theory **(6)**	Has no errors in showing the Kinetic-Molecular Theory **(8)**

T-L #1

Problem: How can a salt and sand mixture be separated?

Hypotheses:

Materials: filter paper, plastic funnel, ring stand and ring, stirring rod,
2 250 mL beakers, small shallow dish (petri dish), 10 g salt/sand mix

Procedure:

1. Obtain a 10 g sample of salt/sand mix.
2. In a 250 mL beaker add 50 mL of water and the salt sand mix. Stir the sample thoroughly.
3. Prepare a piece of filter paper as shown below. Open the paper into a cone leaving a triple layer on one side and a single layer on the other.

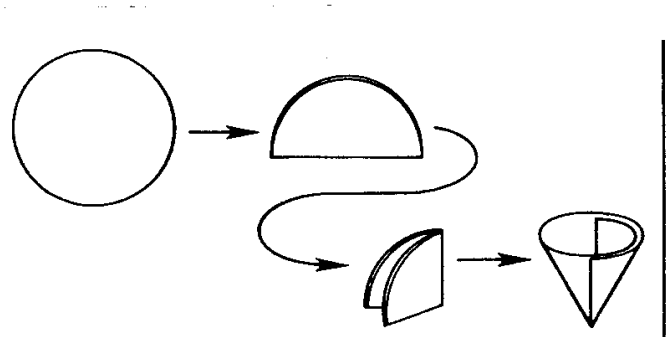


Figure 4

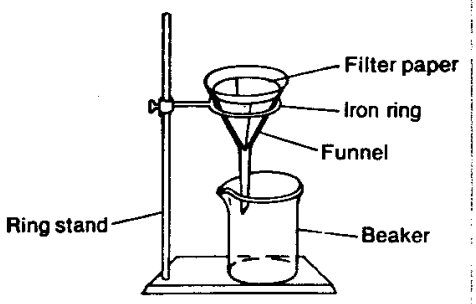


Figure 5

4. Support a funnel as shown. Place the folded filter paper in the funnel and wet the paper slightly so it adheres to the funnel. Set a clean 250 mL beaker under the funnel as shown.
5. Pour the mixture of water/salt/sand slowly into the funnel. Be careful not to go above the filter paper.
6. Use the stirring rod to remove the solid residue into the beaker.
7. Carefully remove the filter paper from the funnel and dispose of it in the wastebasket.
8. Pour some of the filtered material into the shallow dish and set it aside (in a sunny spot, if possible).

Questions:

1. When all of the water has evaporated from the shallow dish, what remains? Describe the substance using physical properties.

2. What is the probable identity of the substance left in the dish?

3. Could a mixture of salt/sugar be separated in the same way? Why or why not?

4. Could 2 liquids such as alcohol and water be separated using filter paper? Explain your answer.

5. Outline a plan that you might use to separate a mixture of water and alcohol.

T-L #3

Worksheet: Isotopes

In each of the following statements, you are given a pair of elements and important information about each. Use this information to determine if the pair of elements are isotopes or different elements. Indicate your answer in the space provided.

1. Element D has 6 protons and 7 neutrons.
   Element F has 7 protons and 7 neutrons. _____

2. Element J has 27 protons and 32 neutrons.
   Element L has 27 protons and 33 neutrons. _____

3. Element X has 17 protons and 18 neutrons.
   Element Y has 18 protons and 17 neutrons. _____

4. Element Q has 56 protons and 81 neutrons.
   Element R has 56 protons and 82 neutrons. _____

5. Element T has an atomic number of 20 and an atomic mass of 40.
   Element Z has an atomic number of 20 and an atomic mass of 41.
_____

6. Element W has 8 protons and 8 neutrons
   Element V has 7 protons and 8 neutrons.
_____

7. Element 92 has an atomic number 92 and an atomic mass of 238.
   Element S has 92 protons and 143 neutrons.
_____

Periodic Table Basics

Step 1: Complete the card for each element.

Complete the top section for each element by adding the element's ❶tomic number, ❷ame, and ❸atomic mass.

❹etermine the number of protons, neutrons, and electrons in each element.

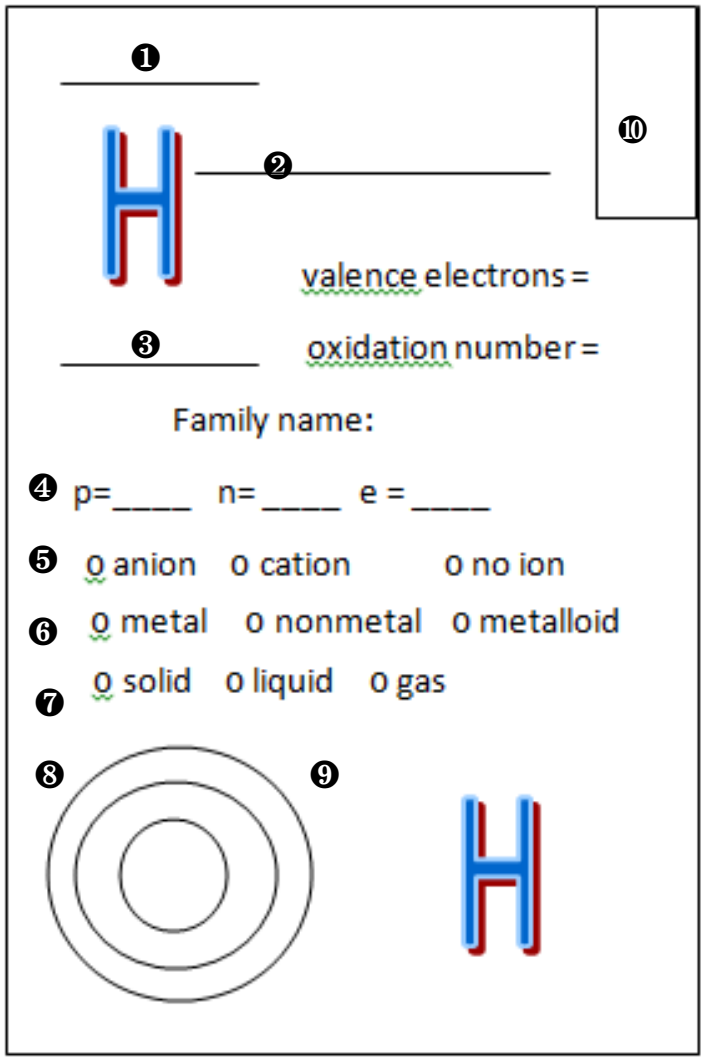
❺arken the correct circle to show if the element is an anion, a cation or no ion.

❻arken the correct circle to show if the element is a metal, nonmetal, or metalloid

❼arken the correct circle to show if the element is a solid, liquid, or gas at room temperature.

❽reate a Bohr diagram for each element.

❾raw the Lewis Structure for each element



Step 2: Use colored pencils to shade in the square in the upper right –hand corner (❿for each element. Hydrogen should **not** be colored!

Green – Li & Na
Pink – O & S
Blue – Be & Mg
Purple – F & Cl
Orange – B & Al
Red – C & Si
Tan – N & P
Yellow – He, Ne & Ar

Step 3: Cut the cards apart and arrange according to atomic number in the pattern shown below on a large sheet of construction paper.

1	Periodic Table						2
3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18

Step 4: After you have the cards arranged in the correct order, glue them to a large piece of construction paper. Add a title at the top of the page along with your name.

Step 5: Answer the questions on the back of this worksheet using the information on your Periodic Table.

_____

C _____

valence electrons =

_____ oxidation number =

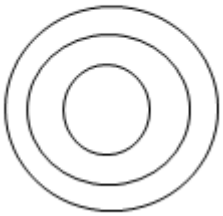
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



C

_____

H _____

valence electrons =

_____ oxidation number =

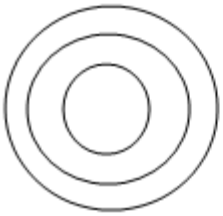
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



H

_____

B _____

valence electrons =

_____ oxidation number =

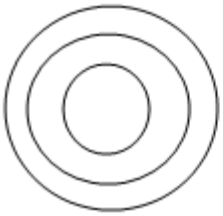
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



B

_____

Li _____

valence electrons =

_____ oxidation number =

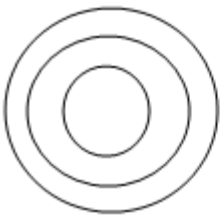
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Li

_____

Be _____

valence electrons =

_____ oxidation number =

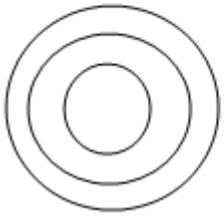
Family name:

p=____ n=____ e = ____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Be

_____

O _____

valence electrons =

_____ oxidation number =

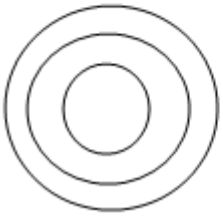
Family name:

p=____ n=____ e = ____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



O

_____

He _____

valence electrons =

_____ oxidation number =

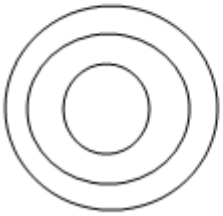
Family name:

p=____ n=____ e = ____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



He

_____

F _____

valence electrons =

_____ oxidation number =

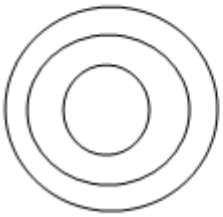
Family name:

p=____ n=____ e = ____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



F

_____

Cl _____

valence electrons =

_____ oxidation number =

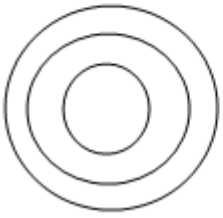
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Cl

_____

Ne _____

valence electrons =

_____ oxidation number =

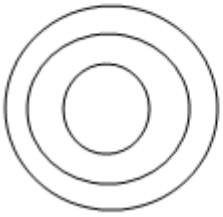
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Ne

_____

N _____

valence electrons =

_____ oxidation number =

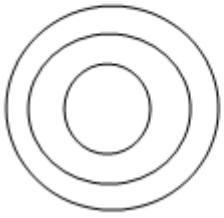
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



N

_____

Ca _____

valence electrons =

_____ oxidation number =

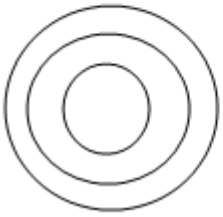
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Ca

_____

Mg _____

valence electrons =

_____ oxidation number =

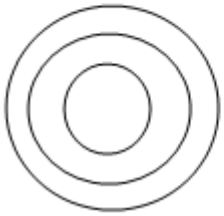
Family name:

p=____ n=____ e = ____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Mg

_____

Ar _____

valence electrons =

_____ oxidation number =

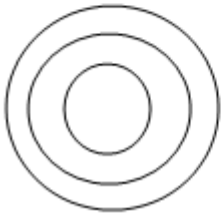
Family name:

p=____ n=____ e = ____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Ar

_____

Al _____

valence electrons =

_____ oxidation number =

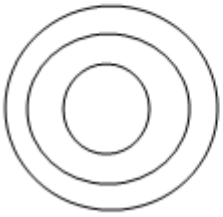
Family name:

p=____ n=____ e = ____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Al

_____

Si _____

valence electrons =

_____ oxidation number =

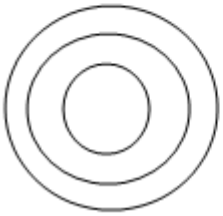
Family name:

p=____ n=____ e = ____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Si

_____

P _____

valence electrons =

_____ oxidation number =

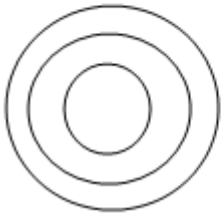
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



P

_____

K _____

valence electrons =

_____ oxidation number =

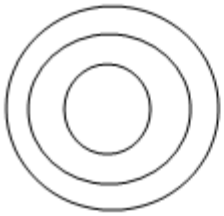
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



K

_____

S _____

valence electrons =

_____ oxidation number =

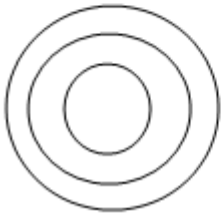
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



S

_____

Na _____

valence electrons =

_____ oxidation number =

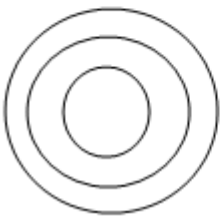
Family name:

p=____ n=____ e =____

o anion o cation o no ion

o metal o nonmetal o metalloid

o solid o liquid o gas



Na

Name_____Block____Date_____

Periodic Table Basics

1. Which elements had complete outer levels? Give the name **and** symbol for each element.

_____ _____ _____ _____ _____ _____

What do you notice about the location of these elements?

2. Which elements had only one valence electron? Give the name and symbol for each element.

_____ _____ _____ _____ _____ _____

What do you notice about the location of these elements?

3. What do you notice about the number of valence electrons as you move from left to right across a row or period in the periodic table? (Na→ Mg→ Al → Si→ P→ S→ Cl →Ar)

4. What do you notice about the number of energy levels as you move down a column or group in the periodic table? (H→ Li→ Na)

5. Write the name of each family at the top of your periodic table using the following information.

Alkali Metals – 1 valence electron	Nitrogen Family – 5 valence electrons
Boron Family – 3 valence electrons	Halogens – 7 valence electrons
Carbon Family – 4 valence electrons	Noble Gases – Complete outer level

6. What do you notice about the location of the elements in each family?

7. In what family would you classify hydrogen? Explain your choice.

8. In what family would each of these elements be classified? (Valence electrons are shown in parenthesis after the name of the element)

Radium (2)– _____ Tin (4) - _____

Iodine (7) - _____ Cesium (1) - _____

9. Predict the number of valence electrons for each element based on its location in the Periodic Table of Elements from your book or handout.

Barium - _____ Lead - _____ Bismuth - _____ Potassium - _____