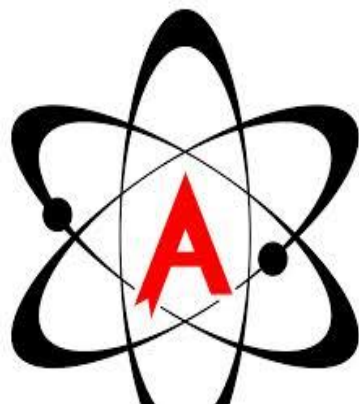
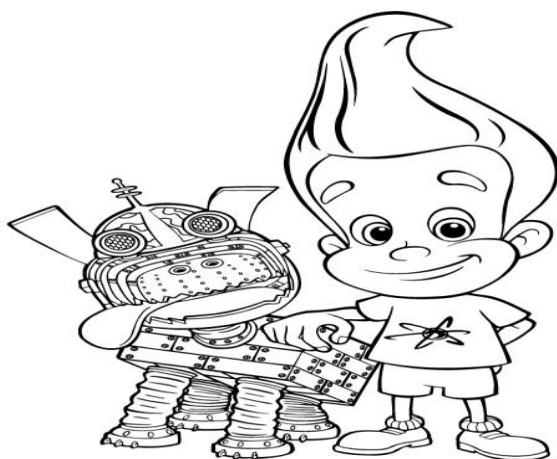


# Atomic Theory



# Structure of the Atom



## CHAPTER 17

**Chapter 17 – Structure of the Atom Vocabulary Words**

<b>Vocabulary Word</b>	<b>Definition</b>
1. Atom	
2. Atomic Number	
3. Average Atomic Mass	
4. Electron	
5. Electron Cloud	
6. Electron Dot Diagram	
7. Group	
8. Isotope	
9. Mass Number	
10. Neutron	
11. Period	
12. Periodic Table	
13. Proton	
14. Quark	

## PROPERTIES OF ATOMS AND THE PERIODIC TABLE

### Section 1: Structure of the Atom – (pages 506 – 511)

- \_\_\_\_\_ are the abbreviated in scientific shorthand – first letter of two of elements' name.
- \_\_\_\_\_ smallest piece of matter that still has the properties of the element.
- \_\_\_\_\_ have electrical charge of  $1-$ .
- \_\_\_\_\_ do not have an electrical charge.
- Protons and neutrons are on the \_\_\_\_\_ of the atom; electrons surround the nucleus.
- Protons and neutrons are made up of smaller particles called \_\_\_\_\_.
- Six quarks are known to exist; the sixth is called the \_\_\_\_\_ quark.
- Scientists use scaled-up \_\_\_\_\_ to represent atoms.
- Early model of atoms used a solid \_\_\_\_\_.
- Current \_\_\_\_\_ model shows electrons traveling in specific energy levels around a nucleus of protons and neutrons.

### Section 2: Masses of Atoms – (pages 512 – 515)

- \_\_\_\_\_ composed mostly of protons and neutron in the nucleus.
- Unit of measurement for atomic particles – \_\_\_\_\_ (amu) which is one-twelfth the mass of a carbon atom containing six protons and six neutrons.
- \_\_\_\_\_ the number of protons in an atom; number of protons also identifies the element.
- The sum of the number of protons and neutrons in the nucleus of an atom is the \_\_\_\_\_.
- \_\_\_\_\_ atoms of the same element with different numbers of neutrons.
- Different isotopes have different \_\_\_\_\_.
- Number of \_\_\_\_\_ is equal to mass number minus atomic number.
- Name of \_\_\_\_\_ followed by mass number identifies the isotope.
- \_\_\_\_\_ is the weighted-average mass of an element's isotopes.
- Average atomic mass is closest to tis most \_\_\_\_\_ isotope.

### Section 3: The Periodic Table – (pages 516 – 524)

- Elements are organized in the \_\_\_\_\_ by increasing atomic number.
- In the late 1800's, Dmitri Mendeleev devised the first periodic table based on \_\_\_\_\_.
- In 1913, Henry G.J. Moseley arranged the elements by \_\_\_\_\_ rather than atomic mass.
- Vertical columns in the periodic table are \_\_\_\_\_ of elements with similar properties.
- Elements in the same group have the same number of \_\_\_\_\_ in their outer energy level.
- Each of the seven energy levels can have a \_\_\_\_\_ number of electrons.
- Energy level one can cannot contain at most \_\_\_\_\_ electrons.
- Energy level two can contain at most \_\_\_\_\_ electrons.
- Each row in the periodic table ends with an outer energy level is \_\_\_\_\_.
- \_\_\_\_\_ use the elements symbol and dots to represent outer energy level electrons.

## PROPERTIES OF ATOMS AND THE PERIODIC TABLE

### Section 3: The Periodic Table– (pages 516 – 524)

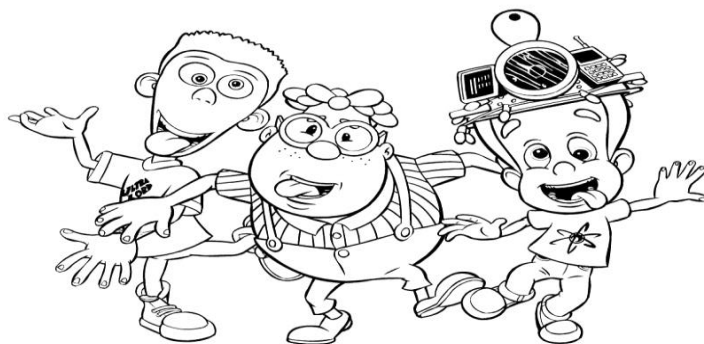
31. \_\_\_\_\_ horizontal rows of elements that contain increasing numbers of protons and electrons.
32. Elements are \_\_\_\_\_ as metals, non-metals, or metalloids (semi-metals).
33. Elements are \_\_\_\_\_ in laboratories all over the world.
34. The \_\_\_\_\_ elements exist all over the universe.
35. Hydrogen and Helium are the \_\_\_\_\_ of other naturally occurring elements.
36. \_\_\_\_\_ spread heavier elements throughout the universe.

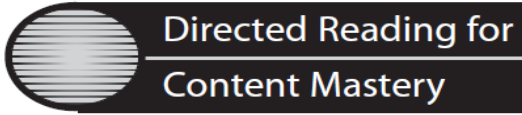
### Section 4: Vocabulary Review

#### Word Box

Metals	Isotopes	Average Atomic Mass	Electron Cloud
Groups	Metalloids	Transition Elements	Atomic Number
Electrons	Nucleus	Mass Number	Periods
Quarks	Periodic Table	Chemical Symbol	

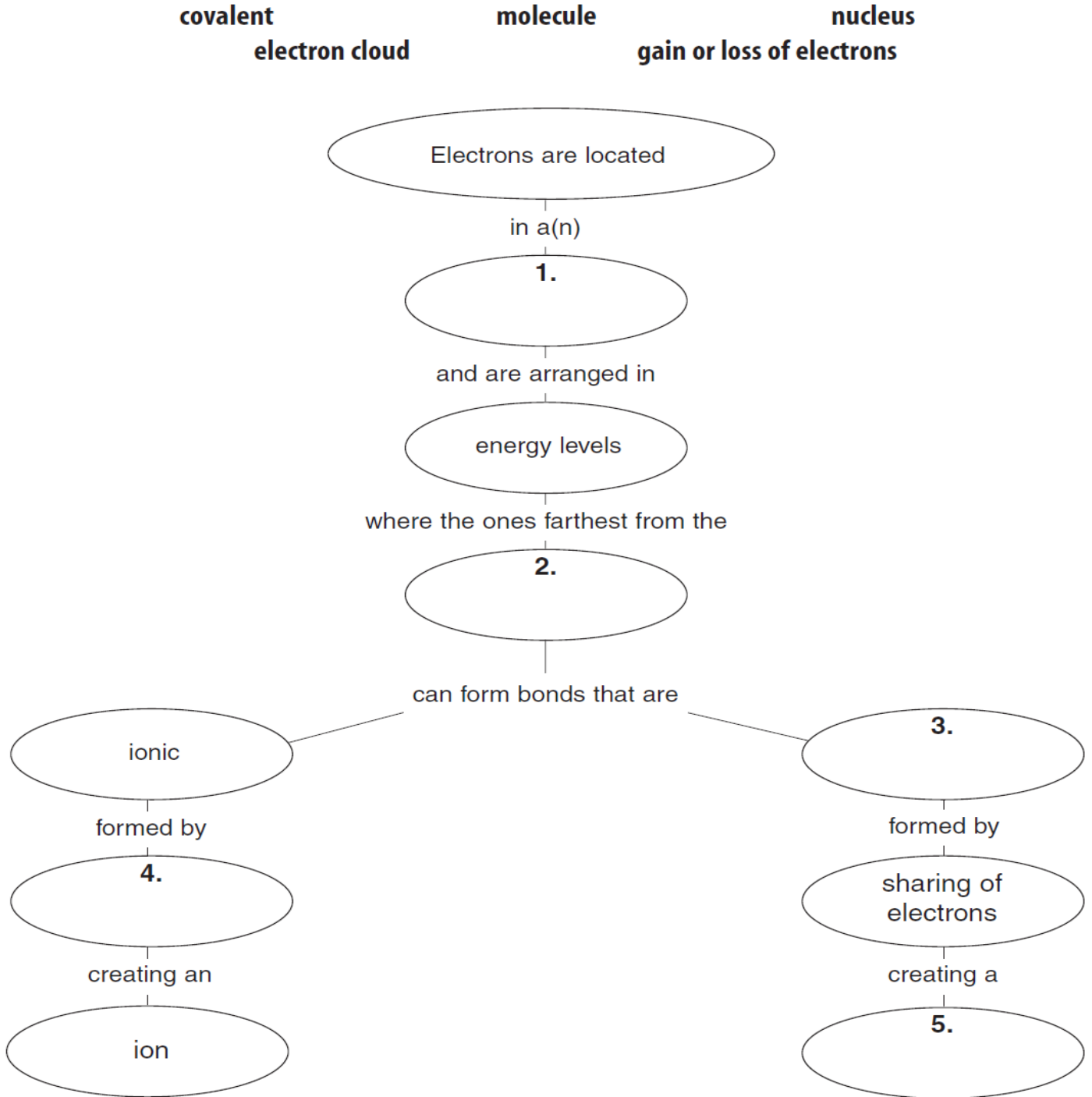
33. \_\_\_\_\_ A capital letter or a combination of a capital letter and a small letter that is used to represent an element is called \_\_\_\_\_.
34. \_\_\_\_\_ The horizontal rows of elements are called \_\_\_\_\_.
35. \_\_\_\_\_ An average of the masses of all the isotopes that occur in nature for an element is the \_\_\_\_\_.
36. \_\_\_\_\_ Vertical columns of elements are called \_\_\_\_\_.
37. \_\_\_\_\_ Elements in the middle of the periodic table, groups 4 through 7, are called \_\_\_\_\_.
38. \_\_\_\_\_ The number of protons in an atom is the \_\_\_\_\_.
39. Protons and Neutrons can be subdivided into \_\_\_\_\_ by colliding them.
40. The center of an atom where protons and neutrons are located is the \_\_\_\_\_.
41. A total count of the neutrons and protons in an atom is the \_\_\_\_\_.
42. Atoms of the same element but with different numbers of neutrons are \_\_\_\_\_.
43. Elements that are found on the left side of the periodic table are \_\_\_\_\_.
44. Elements that have some properties of both metals and nonmetals are \_\_\_\_\_.
45. The particles that move about the nucleus and have a negative charge are \_\_\_\_\_.
46. The region around the nucleus occupied by electrons is an \_\_\_\_\_.
47. A chart that shows the classification of elements is called the \_\_\_\_\_.





# Overview Atomic Structure and Chemical Bonds

Directions: Complete the concept map using the terms listed below.





Directed Reading for  
Content Mastery

## Key Terms

# Atomic Structure and Chemical Bonds

**Directions:** Use the following terms to complete the sentences below.

polar bond

compound

chemical bond

ion

ionic bond

covalent bond

polar molecule

electron cloud

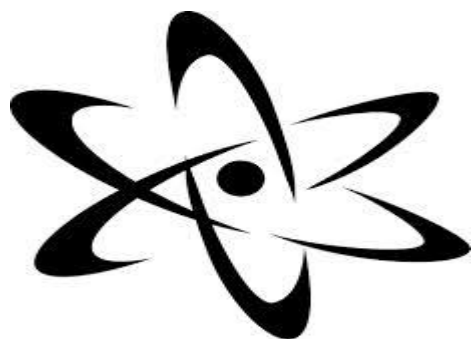
molecule

formula

electron dot diagram

metallic bond

- Ions are held close together by a(n) \_\_\_\_\_.
- A charged atom particle is called a(n) \_\_\_\_\_.
- A force that holds two atoms together is a(n) \_\_\_\_\_.
- A pure substance that contains two or more elements is a(n) \_\_\_\_\_.
- A(n) \_\_\_\_\_ forms between atoms when they share electrons.
- A(n) \_\_\_\_\_ is formed when atoms form covalent bonds.
- NaCl is an example of a chemical \_\_\_\_\_.
- A(n) \_\_\_\_\_ is a way to represent atoms and electrons in their outer energy levels.
- Electrons are shared unequally in a(n) \_\_\_\_\_.
- A(n) \_\_\_\_\_ has a slight positive charge on one end and a slight negative charge on the other end.
- The area of space around the nucleus in which an atom's electrons travel is called the \_\_\_\_\_.
- When metal atoms share their pooled electrons, a \_\_\_\_\_ is formed.



# History of the Atom

## Atoms

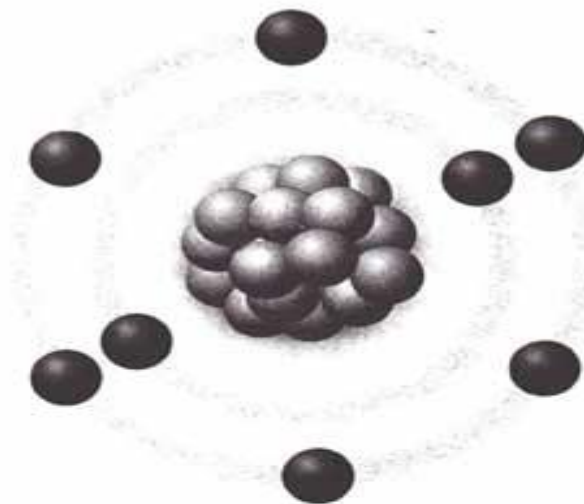
### What is the structure of an atom?

An **atom** is the smallest particle that an element can be divided into and still be the same element. An atom consists of a small, dense **nucleus** surrounded by electron clouds. Most of an atom's mass is in its nucleus, so most of the atom is empty space. The mass of an atom is expressed in **atomic mass units (amu)**.

The nucleus contains protons and neutrons. **Protons** are particles that have a positive electric charge. The protons of all elements are identical, but the number of protons differs from element to element. The number of protons in the nucleus of an element's atoms is the **atomic number** of that element. Oxygen atoms have 8 protons, so the atomic number of oxygen is 8.

**Neutrons** are particles in the nucleus that have no electric charge. Atoms of the same element may have different numbers neutrons. These atoms are called **isotopes**. For example, the most common isotope of oxygen has 8 neutrons, but other oxygen isotopes have 9 or 10 neutrons. An atom's **mass number** is the total number of its protons and neutrons.

**Electrons** are particles with a negative electric charge. They are likely to be found



Structure of an oxygen atom

within electron clouds outside the nucleus. Electrons are so tiny that they have almost no mass. An atom has equal numbers of electrons and protons. Because the positive charge of the protons cancels out the negative charge of the electrons, an atom has no overall charge.

### Show What You Know

An atom of gold has an atomic number of 79 and a mass number of 197.  
How many protons, electrons, and neutrons does this atom have?

1. Number of protons: \_\_\_\_\_
2. Number of electrons: \_\_\_\_\_
3. Number of neutrons: \_\_\_\_\_

56 <b>Ba</b> 137.33 barium	27 <b>Co</b> 58.933 cobalt	7 <b>N</b> 14.007 nitrogen
-------------------------------------	-------------------------------------	-------------------------------------

# Atomic Theories

## History of the Atom

By Matt Rosa

**Democritus** (460BC) - He proposed that all matter, including space and time, was made up of small units named atoms. He did no experiments and had little evidence, but his idea was kept on by Lucretius.

**Mendeleev** (1803) - Created the periodic table of elements which organizes elements according to their similarities. His Period Law states that "physical and chemical of the elements are periodic functions of their atomic numbers."

**Dalton** (1803) - Agreed that all matter was created by atoms, which he believed were indestructible. He also stated that compounds are created by combining two atoms, and that all atoms of given elements are identical in their mass and properties.

**Henri Becquerel** (1859) - Discovered radioactivity, which earned him a Nobel Prize. Also discovered that rays emitted from uranium caused gases to ionize.

**Eugene Goldstein** (1869) - Discovered positive particles. He noted that the particles had a charge equal and opposite to the electron.

**J.J. Thomson** (1897) - Discovered the electron. He experimented by testing and studying the nature of electric discharge in a high vacuum cathode-ray tube.

**Ernest Rutherford** (1907) - Used the gold foil experiment to discover the modern model of an atom. He concluded that all positive charges were centralized, while negative electrons orbited the nucleus.

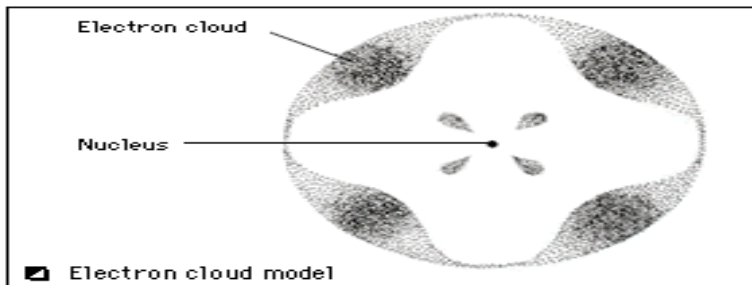
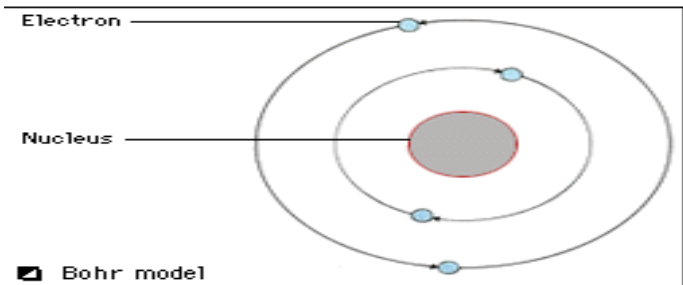
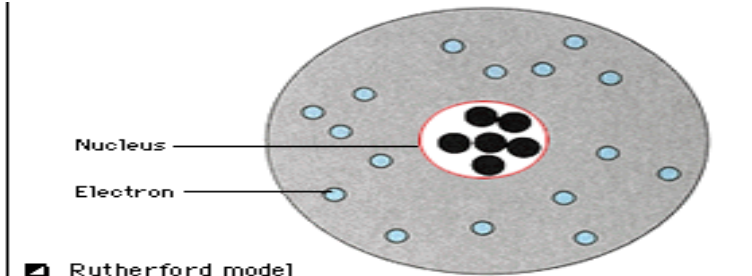
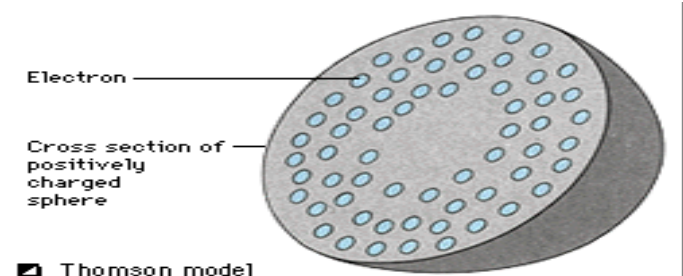
**Millikan** (1909) - Used an oil drop experiment to determine the charge of a single electron.

**Frederick Soddy** (1913) - Came up with the concept of isotopes. Explain with Ernest Rutherford that radiation is due to transmutation of elements.

**Neils Bohr** (1913) - Explained that outer orbits in an atom could hold more electrons than the inner orbits. By knowing this, one can determine the atom's chemical properties. He also gave birth to the idea that electrons emit light by jumping orbits.

**Heisenberg** (1925) - Thought of the Uncertainty Principle. This principle states that one can never know the exact location and energy of an electron simultaneously.

**Chadwick** (1932) - Discovered the neutron. The neutron helps balance out protons in the nucleus of an atom.





# ATOMIC STRUCTURE

Name \_\_\_\_\_

An atom is made up of protons and neutrons (both found in the nucleus) and electrons (in the surrounding electron cloud). The atomic number is equal to the number of protons. The mass number is equal to the number of protons plus neutrons. In a neutral atom, the number of protons equals the number of electrons. The charge on an ion indicates an imbalance between protons and electrons. Too many electrons produces a negative charge, too few, a positive charge.

This structure can be written as part of a chemical symbol.

**Example:**

$$\begin{array}{c}
 \text{mass} \\
 \text{number} \\
 \downarrow \\
 15\text{N}^{+3} \\
 \uparrow \\
 7 \\
 \text{atomic} \\
 \text{number}
 \end{array}$$

charge

7 protons  
8 neutrons (15 - 7)  
4 electrons



Complete the following chart.

Element/ Ion	Atomic Number	Atomic Mass	Mass Number	Protons	Neutrons	Electrons
H						
H <sup>+</sup>						
<sup>12</sup> <sub>6</sub> C						
<sup>7</sup> <sub>3</sub> Li <sup>+</sup>						
<sup>35</sup> <sub>17</sub> Cl <sup>-</sup>						
<sup>39</sup> <sub>19</sub> K						
<sup>24</sup> <sub>12</sub> Mg <sup>2+</sup>						
As <sup>3-</sup>						
Ag						
Ag <sup>+</sup>						
S <sup>-2</sup>						
U						





The atomic  
symbol for  
**Rapper**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

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

**Mass and Atomic Number Worksheet**

Name of Element	Symbol	Atomic Number	Atomic Mass	Protons	Neutrons	Electrons
Copper				29	35	29
Tin	Sn				69	50
	I	53	127			
Uranium			238			92
	K			19	20	
Lithium			7	3		
	O	8			8	
Gold		79	197			
		16	32	16		
Silver		47	108	47		
Chromium					28	24
	Co		59		32	27
	Ni			28		
Zinc		30			35	
	Al				14	13
	Hg	80	201			
Platinum			195			
	Fe		56		30	
	H	1	1			
	He	2	4			
		4		4		4
	Mg			12	12	12
	C	6		6	6	
Silicon		14			14	
	Cl			17	18	
	Bi		209			83
Boron		5	11			
	Ca	20				20
		25	55	25		
Lead			207			82
Sodium	Na					
Fluorine				9	10	9
	P	15	31			



## It All Adds Up

- You can use the periodic table to find the number of protons, neutrons, and electrons that the atoms of an element have.

Atomic number = number of protons

Number of protons = number of electrons

Mass number = number of protons + number of neutrons

so

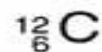
Mass number – atomic number = number of neutrons

All atoms of a particular element have the same number of protons and electrons, but the atoms may differ in the number of neutrons they have. Atoms of the same element with different numbers of neutrons are called **isotopes**. Isotopes have the same atomic number but different atomic masses. In nature, an element is found as a mixture of different isotopes. The atomic masses or weights in the periodic table are the average for an element's isotopes.

Isotopes can be written in two ways:

Carbon-12

or



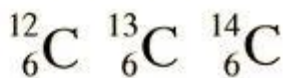
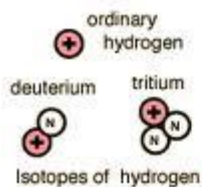
12 is the mass number of carbon.

6 is the atomic number of carbon.

C is the chemical symbol for carbon.

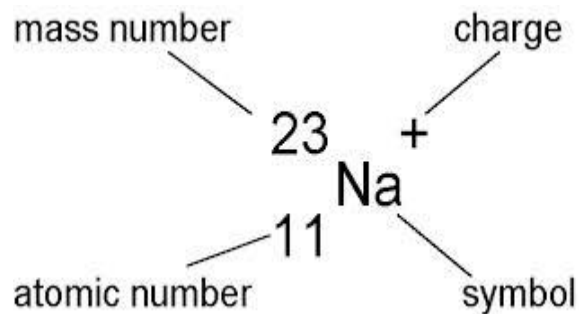
Use the periodic table to fill in information about the isotopes in the chart below.

Substance	Mass Number	Number of		
		Protons	Neutrons	Electrons
1. carbon-14				
2. lead-208				
3. uranium-239				
4. uranium-238				
5. tin-118				



Notation for the different isotopes of the chemical element carbon.

There are about 400 stable isotopes.



hydrogen-1  
(protium)

hydrogen-2  
(deuterium)

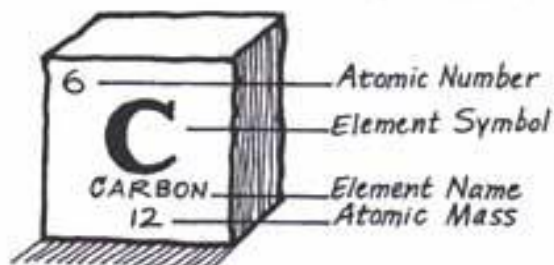
hydrogen-3  
(tritium)

# A WORLD-FAMOUS TABLE

There is a table (not one for dinner) that's probably the most famous table of science.

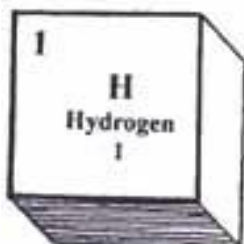
If you learn how to read it, you'll have quick access to important stuff about elements. It's called the Periodic Table (because it's written in rows, called periods).

Build your skill at reading the Periodic Table by finding the missing information in the samples below.



## REMEMBER:

atomic mass = protons + neutrons  
 atomic number = # protons  
 # protons = # electrons

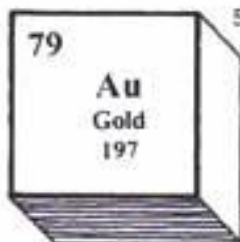


1. a. atomic number

\_\_\_\_\_

b. atomic mass

\_\_\_\_\_



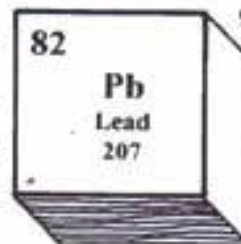
5. a. # electrons

b. # protons

c. atomic number

d. name of element

\_\_\_\_\_



9. a. element name

b. # protons

\_\_\_\_\_

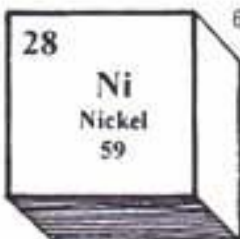


2. a. element name

\_\_\_\_\_

b. atomic number

\_\_\_\_\_

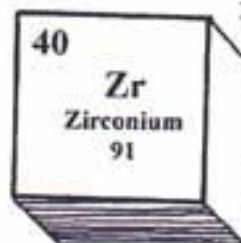


6. a. atomic mass

\_\_\_\_\_

b. element symbol

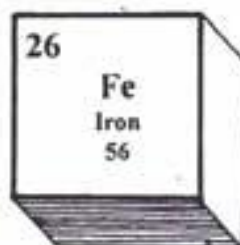
\_\_\_\_\_



10. a. # electrons

b. atomic mass

\_\_\_\_\_

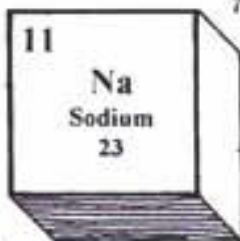


3. a. # protons

\_\_\_\_\_

b. element symbol

\_\_\_\_\_

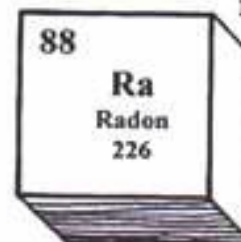


7. a. element symbol

b. # neutrons

c. element name

\_\_\_\_\_



11. a. atomic number

b. # neutrons

\_\_\_\_\_

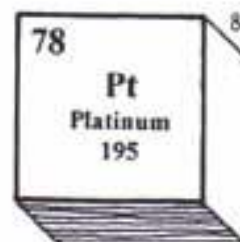


4. a. atomic number

\_\_\_\_\_

b. element name

\_\_\_\_\_

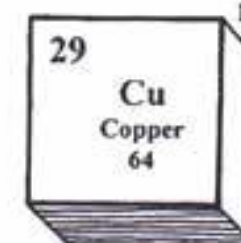


8. a. atomic number

\_\_\_\_\_

b. # neutrons

\_\_\_\_\_



12. a. atomic mass

b. # neutrons

\_\_\_\_\_

Name \_\_\_\_\_

## Broughton High School of Wake County

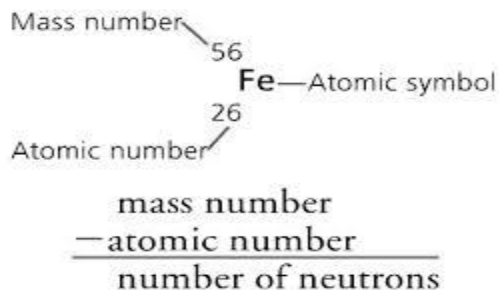
Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Atomic Structure and the Periodic Table Worksheet**

Name	Symbol	Family Group	Period	Atomic #	#p+	#n	#e-
Neon							
Carbon							
	O						
	Cr						
		Halogen	5				
Uranium							
					82		
	Ag						
					36		
				37			
		Nobel gas	1				
		Alkali metal	4				
	Sn						

**Answer these questions.**

1. Explain where the weight of an atom is found, what is responsible for that weight, and why.
2. What are protons? Explain what value or function they serve in an atom.
3. What are electrons? Explain what value or function they serve in an atom.
4. What are neutrons? Explain what value or function they serve in an atom.
5. Explain the "Plum Pudding" model.
6. What valuable and amazing information was discovered in the Gold Foil experiment?
7. When Niels Bohr refined the model of an atom, what new idea did he include?





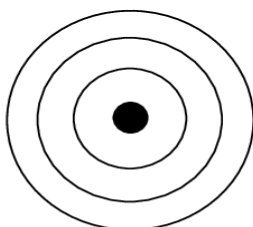
Name: \_\_\_\_\_

Date: \_\_\_\_\_

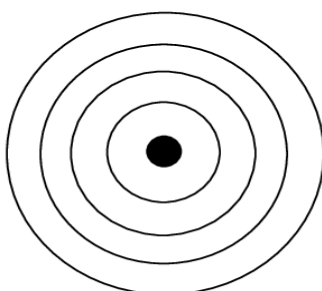
Period: \_\_\_\_\_

## Bohr Model Practice

he total number of electrons on the line. Then color the correct number of electrons for each orbit. Remember, fill the orbit closest to the nucleus first, but never exceed the number each orbit can hold. Check the Periodic Table to find out how many electrons each element actually has.



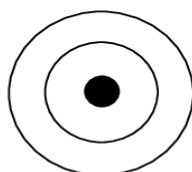
Sodium (Na) \_\_\_\_\_



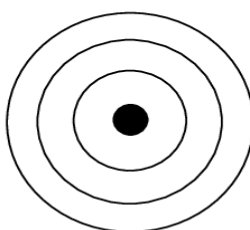
Potassium (K) \_\_\_\_\_



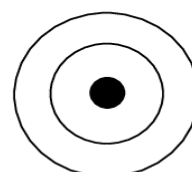
Hydrogen (H) \_\_\_\_\_



Carbon (C) \_\_\_\_\_





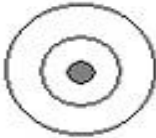
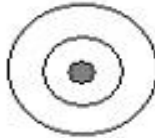
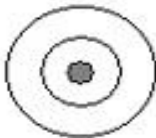

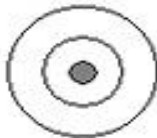
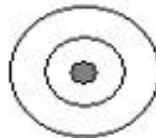
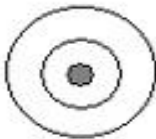

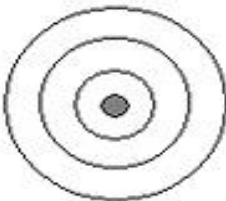
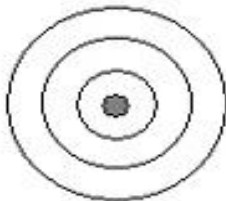
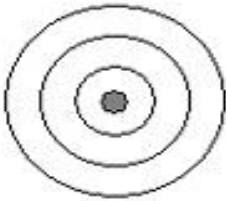
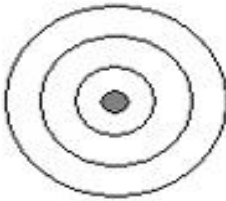
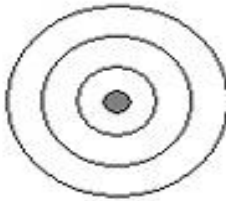
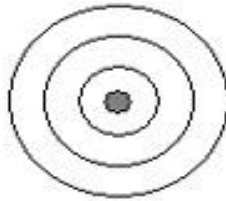
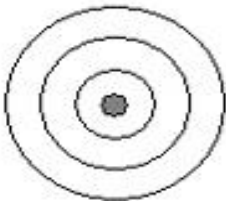
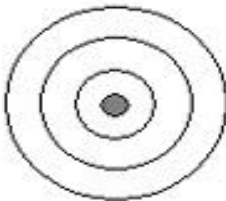
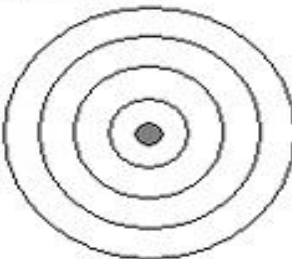
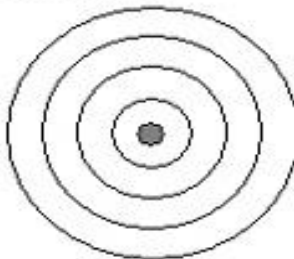
Silicon (Si) \_\_\_\_\_



Oxygen (O) \_\_\_\_\_

PERIODIC TABLE ELEMENTS 1-20							
HYDROGEN 1 <b>H</b> ·							HELIUM 2 <b>He</b> ·
LITHIUM 3 <b>Li</b> ·	BERYLLIUM 4 <b>Be</b> ·	BORON 5 <b>B</b> ·	CARBON 6 <b>C</b> ·	NITROGEN 7 <b>N</b> ·	OXYGEN 8 <b>O</b> ·	FLUORINE 9 <b>F</b> ·	NEON 10 <b>Ne</b> ·
SODIUM 11 <b>Na</b> ·	MAGNESIUM 12 <b>Mg</b> ·	ALUMINUM 13 <b>Al</b> ·	SILICON 14 <b>Si</b> ·	PHOSPHORUS 15 <b>P</b> ·	SULFUR 16 <b>S</b> ·	CHLORINE 17 <b>Cl</b> ·	ARGON 18 <b>Ar</b> ·
POTASSIUM 19 <b>K</b> ·	CALCIUM 20 <b>Ca</b> ·						

**Bohr Model Practice Problems**

Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  
Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  
Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  
Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  
Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  	Element: Atomic number:  

## Chemistry of Life Worksheet I

Complete the following Bohr Models and fill in the blanks:

### Hydrogen

Symbol: \_\_\_\_\_

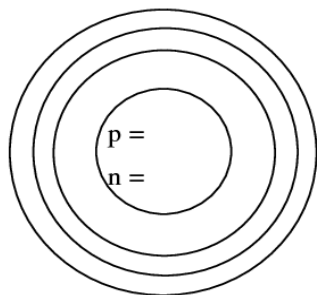
No. of Electrons: \_\_\_\_\_

Atomic Number: \_\_\_\_\_

Atomic Mass: \_\_\_\_\_

Oxidation Number: \_\_\_\_\_

Electron Configuration: \_\_\_\_\_



### Carbon

Symbol: \_\_\_\_\_

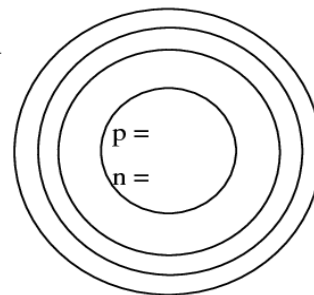
No. of Electrons: \_\_\_\_\_

Atomic Number: \_\_\_\_\_

Atomic Mass: \_\_\_\_\_

Oxidation Number: \_\_\_\_\_

Electron Configuration: \_\_\_\_\_



### Phosphorous

Symbol: \_\_\_\_\_

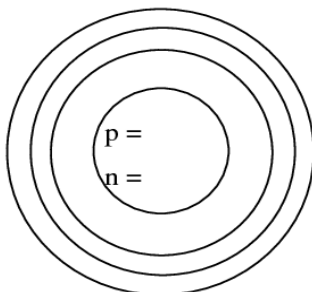
No. of Electrons: \_\_\_\_\_

Atomic Number: \_\_\_\_\_

Atomic Mass: \_\_\_\_\_

Oxidation Number: \_\_\_\_\_

Electron Configuration: \_\_\_\_\_



### Chlorine

Symbol: \_\_\_\_\_

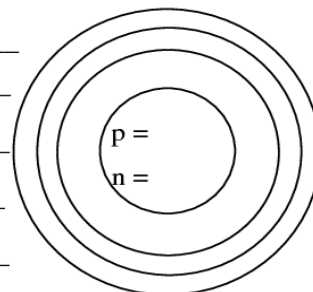
No. of Electrons: \_\_\_\_\_

Atomic Number: \_\_\_\_\_

Atomic Mass: \_\_\_\_\_

Oxidation Number: \_\_\_\_\_

Electron Configuration: \_\_\_\_\_



### Oxygen

Symbol: \_\_\_\_\_

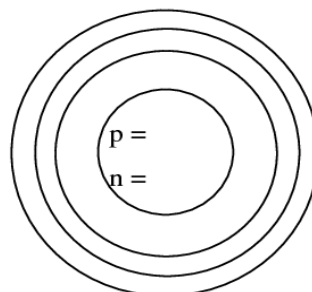
No. of Electrons: \_\_\_\_\_

Atomic Number: \_\_\_\_\_

Atomic Mass: \_\_\_\_\_

Oxidation Number: \_\_\_\_\_

Electron Configuration: \_\_\_\_\_



### Sodium

Symbol: \_\_\_\_\_

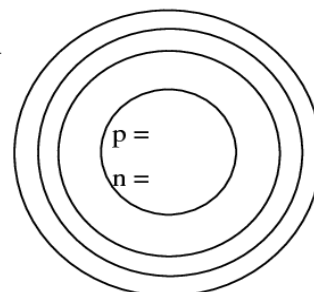
No. of Electrons: \_\_\_\_\_

Atomic Number: \_\_\_\_\_

Atomic Mass: \_\_\_\_\_

Oxidation Number: \_\_\_\_\_

Electron Configuration: \_\_\_\_\_



### Potassium

Symbol: \_\_\_\_\_

No. of Electrons: \_\_\_\_\_

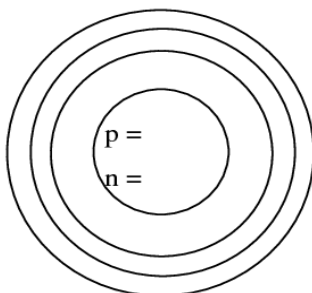
Atomic Number: \_\_\_\_\_

Atomic Mass: \_\_\_\_\_

Oxidation Number: \_\_\_\_\_

Electron Configuration: \_\_\_\_\_

*Chemistry of Life Worksheet I.doc 9/18/2007*



### Nitrogen

Symbol: \_\_\_\_\_

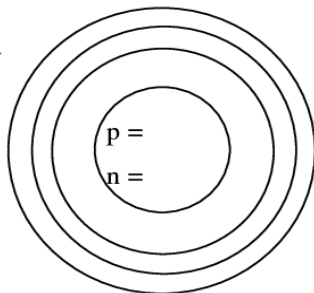
No. of Electrons: \_\_\_\_\_

Atomic Number: \_\_\_\_\_

Atomic Mass: \_\_\_\_\_

Oxidation Number: \_\_\_\_\_

Electron Configuration: \_\_\_\_\_





## Broughton High School of Wake County

Chapter Review Worksheet.

Name \_\_\_\_\_

Period \_\_\_\_\_ Date \_\_\_\_\_

**True-False** Classify each of the following statements as always true, **AT**; sometimes true, **ST**; or never true, **NT**.

- \_\_\_\_\_ 1. According to Dalton's atomic theory, atoms are composed of protons, electrons, and neutrons.
- \_\_\_\_\_ 2. Atoms of elements are electrically neutral.
- \_\_\_\_\_ 3. The mass of an electron is equal to the mass of a neutron.
- \_\_\_\_\_ 4. The charge on all protons is the same.
- \_\_\_\_\_ 5. The atomic number of an element is the sum of the protons and electrons in the atom.
- \_\_\_\_\_ 6. The atomic number of an element is the whole number that decreases as you read across each row of the periodic table from left to right.
- \_\_\_\_\_ 7. An atom of nitrogen has 7 protons and 7 neutrons.
- \_\_\_\_\_ 8. Relative atomic masses are measured in amu.
- \_\_\_\_\_ 9. The number of neutrons in the nucleus can be calculated by subtracting the atomic from the mass number.

10. Complete the following table.

Element	Symbol	Atomic Number	Mass Number	Number of Protons	Number of Electrons	Number of neutrons
Carbon			12		6	
	K	19				21
		12				12
Helium		2	4			
		5				6

11. Complete the following table

Element	Symbol	Number of Protons	Number of electrons	Number of neutrons	Atomic Number	Mass Number
		25				53
			11	12		
		35		45		
					39	89
			33			75
	Ac					227

12. Fill in the following Table

Element	Symbol	Atomic Number	Mass Number	Number of neutrons
nitrogen-15				8
	$^{22}_{10}\text{Ne}$			
Beryllium-9		4		

## Element Crossword Puzzle

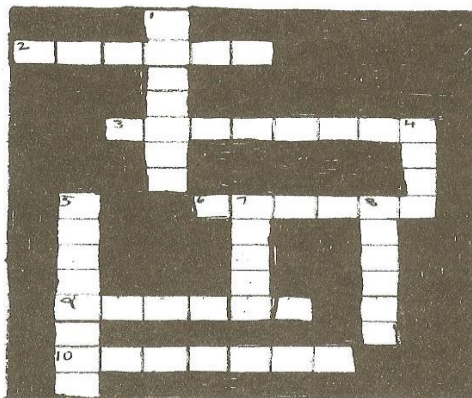
### Symbols

#### Across

- This element's chemical symbol is He.
- This element's chemical symbol is N.
- This element's chemical symbol is C.
- This element's chemical symbol is I.
- This element's chemical symbol is U.

#### Down

- This element's chemical symbol is Li.
- This element's chemical symbol is Ne.
- This element's chemical symbol is Al.
- This element's chemical symbol is Ar.
- This element's chemical symbol is O.



Element Symbol	Element Name	# of Protons	# of Neutrons	# of Electrons
He				
N				
C				
I				
U				
Li				
Ne				
Al				
Ar				
O				

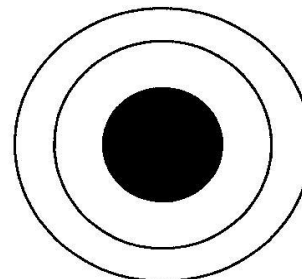


## Atomic Basics

Name \_\_\_\_\_

## Part A: Atomic Structure

1. Draw five protons in the nucleus of the atom. Label them with their charge.
2. Draw six neutrons in the nucleus of the atom.
3. Draw two electrons in the first energy level and label them with their charge.
4. Draw three electrons in the second energy level and label them with their charge.
5. What element is represented by the diagram? \_\_\_\_\_



## Part B: Atomic Calculations

6. Label the information provided in the periodic table.

8	← _____
O	← _____
Oxygen	← _____
15.999	← _____

7. What does the atomic number represent?  
\_\_\_\_\_ or \_\_\_\_\_

8. What does the atomic mass represent?  
\_\_\_\_\_ + \_\_\_\_\_

9. How would you figure the number of protons or electrons in an atom?

10. How would you figure the number of neutrons in an atom?

11. Use your knowledge of atomic calculations to complete the chart.

Element	Atomic Number	Atomic Mass	Protons	Neutrons	Electrons
<b>Li</b>	3	7			
<b>P</b>	15	31			
<b>Cl</b>		35	17		
<b>Ni</b>	28			31	
<b>K</b>		39			19
<b>Ag</b>	47			61	
<b>H</b>		1	1		
<b>Si</b>				14	14
<b>W</b>			74	110	
<b>Ne</b>				10	10

**The Atoms Family  
Atomic Math Challenge**

Name \_\_\_\_\_

8 O Oxygen 15.999	←	_____
←	_____	
←	_____	
←	_____	

**Atomic number** equals  
the number of

or

**Atomic mass** equals  
the number of

+

8 O _____ 15.999
---------------------------

Atomic # = \_\_\_\_\_  
Atomic Mass = \_\_\_\_\_  
# of Protons = \_\_\_\_\_  
# of Neutrons = \_\_\_\_\_  
# of Electrons = \_\_\_\_\_

30 _____ Zinc 65.39
------------------------------

Atomic # = \_\_\_\_\_  
Atomic Mass = \_\_\_\_\_  
# of Protons = \_\_\_\_\_  
# of Neutrons = \_\_\_\_\_  
# of Electrons = \_\_\_\_\_

3 Li _____ 6.941
---------------------------

Atomic # = \_\_\_\_\_  
Atomic Mass = \_\_\_\_\_  
# of Protons = \_\_\_\_\_  
# of Neutrons = \_\_\_\_\_  
# of Electrons = \_\_\_\_\_

14 _____ Silicon 28.086
----------------------------------

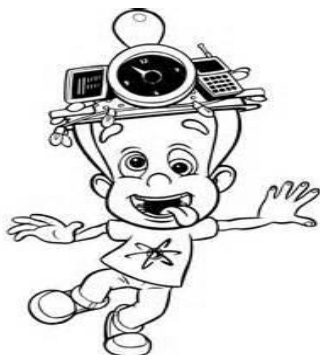
Atomic # = \_\_\_\_\_  
Atomic Mass = \_\_\_\_\_  
# of Protons = \_\_\_\_\_  
# of Neutrons = \_\_\_\_\_  
# of Electrons = \_\_\_\_\_

5 B _____ 10.81
--------------------------

Atomic # = \_\_\_\_\_  
Atomic Mass = \_\_\_\_\_  
# of Protons = \_\_\_\_\_  
# of Neutrons = \_\_\_\_\_  
# of Electrons = \_\_\_\_\_

35 _____ Bromine 79.904
----------------------------------

Atomic # = \_\_\_\_\_  
Atomic Mass = \_\_\_\_\_  
# of Protons = \_\_\_\_\_  
# of Neutrons = \_\_\_\_\_  
# of Electrons = \_\_\_\_\_

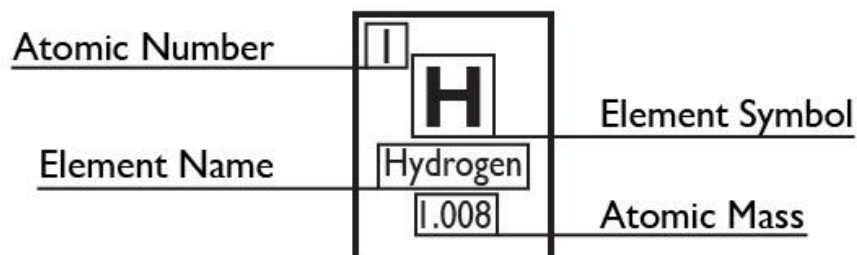


Name: \_\_\_\_\_

Date: \_\_\_\_\_

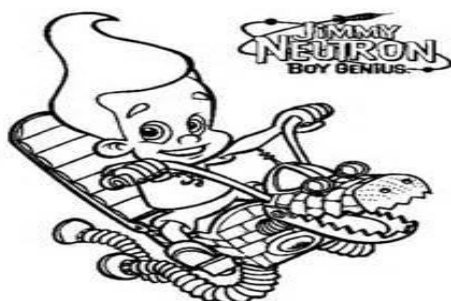
## Periodic Table Worksheet

The Periodic Table contains the following information for each element.



Complete the missing information for each of the following elements from a periodic table.

<b>B</b>	Aluminum	56	Sodium	<b>Co</b>
63.546	53	Tin	<b>W</b>	72.631
93	32.066	<b>Kr</b>	88.906	Gold
Europium	<b>Fe</b>	82	Potassium	107.868



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# Periodic Table Spell It

## *What Words Can You Spell?*

Using the element symbols, construct as many English words as possible. The words must be spelled in the traditional manner and must be found in a typical dictionary. Be sure to write down the element symbol, the atomic number, and the element name inside the box.

EXAMPLE:

15
<b>P</b>
Phosphorus

1
<b>H</b>
Hydrogen

8
<b>O</b>
Oxygen

10
<b>Ne</b>
Neon

Two Box Words:

--

--

--

--

Three Box Words:

--

--

--

--

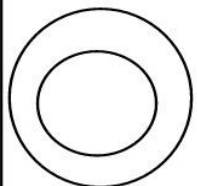
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Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

### BOHR ATOMIC MODELS

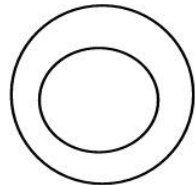
**Hydrogen**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



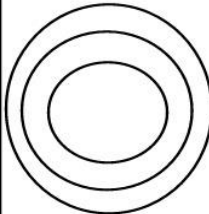
Procedure:

1. Draw Bohr atomic models for each of the atoms using your Periodic Table
2. To represent the # of protons write a P- followed by the number of protons. Place in nucleus.
3. To represent the # of neutrons write a N- followed by the number of neutrons. Place in nucleus.
4. Use periodic table to determine how many electrons are in each orbital.
5. Use dots to represent the electrons. Pair electrons after the 1st orbital to make for easier counting.
6. Be sure to write the symbol, atomic #, and mass # for each element.
7. See Carbon as an example of what your Bohr model should look like.
8. Answer "Atomic Models Questions" after you have finished.

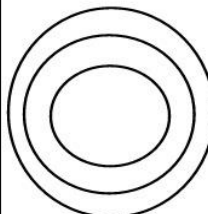
**Helium**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



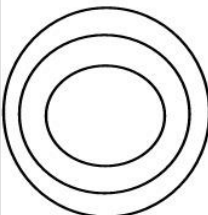
**Lithium**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



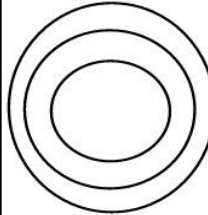
**Beryllium**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



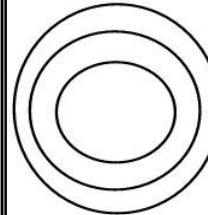
**Boron**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



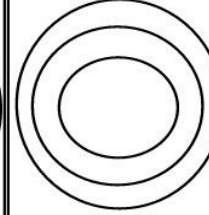
**Carbon**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



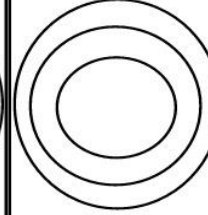
**Nitrogen**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



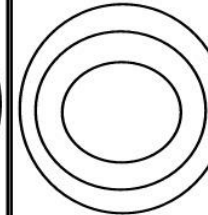
**Oxygen**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



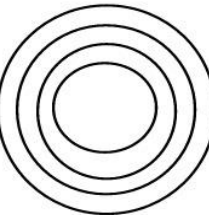
**Fluorine**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



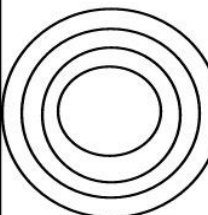
**Neon**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



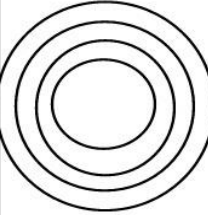
**Sodium**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



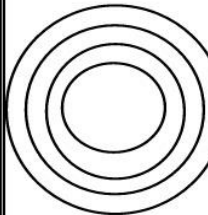
**Magnesium**  
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 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



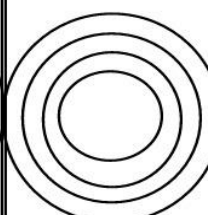
**Aluminum**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



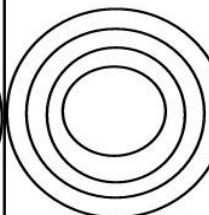
**Silicon**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



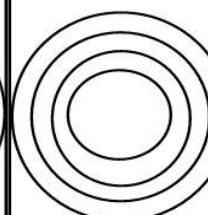
**Phosphorus**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



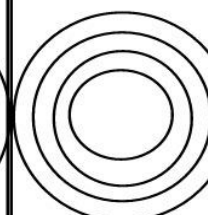
**Sulfur**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



**Chlorine**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



**Argon**  
 Symbol \_\_\_\_\_  
 Atomic Number \_\_\_\_\_  
 Mass Number \_\_\_\_\_



Broughton High School of Wake County

# Periodic Table of the Elements

Period	1																	18																		
	1	1.00794 1 1																	4.00260 2 2																	
		Group	1	2											Group	13	14	15	16	17	18															
2	3	6.941 3 2-1	4	9.01218 4 2-2											5	6	7	8	9	10																
3	11	22.98977 11 2-8-1	12	24.305 12 2-8-2											13	14	15	16	17	18																
4	19	39.0983 19 2-8-8-1	20	40.08 20 2-8-8-2	21	44.9559 21 2-8-9-2	22	47.88 22 2-8-10-2	23	50.9415 23 2-8-11-2	24	51.996 24 2-8-13-1	25	54.9380 25 2-8-13-2	26	55.847 26 2-8-14-2	27	58.9332 27 2-8-15-2	28	58.69 28 2-8-16-2	29	63.546 29 2-8-18-1	30	65.39 30 2-8-18-2	31	69.72 31 2-8-18-3	32	72.59 32 2-8-18-4	33	74.9216 33 2-8-18-5	34	78.96 34 2-8-18-6	35	79.904 35 2-8-18-7	36	83.80 36 2-8-18-8
5	37	85.4678 37 2-8-18-8-1	38	87.62 38 2-8-18-8-2	39	88.9059 39 2-8-18-9-2	40	91.224 40 2-8-18-10-2	41	92.9064 41 2-8-18-12-1	42	95.94 42 2-8-18-13-1	43	(98) 43 2-8-18-14-1	44	101.07 44 2-8-18-15-1	45	102.906 45 2-8-18-16-1	46	106.42 46 2-8-18-18	47	107.868 47 2-8-18-18-1	48	112.41 48 2-8-18-18-2	49	114.82 49 2-8-18-18-3	50	118.71 50 2-8-18-18-4	51	121.75 51 2-8-18-18-5	52	127.60 52 2-8-18-18-6	53	126.905 53 2-8-18-18-7	54	131.29 54 2-8-18-18-8
6	55	132.905 55 2-8-18-18-8-1	56	137.33 56 2-8-18-18-8-2	57	138.906 57 2-8-18-18-9-2	72	178.49 72 2-8-18-10-2	73	180.948 73 2-8-18-11-2	74	183.85 74 2-8-18-12-2	75	186.207 75 2-8-18-13-2	76	190.2 76 2-8-18-14-2	77	192.22 77 2-8-18-15-2	78	195.08 78 2-8-18-17-1	79	196.967 79 2-8-18-18-1	80	200.59 80 2-8-18-18-2	81	204.383 81 2-8-18-18-3	82	207.2 82 2-8-18-18-4	83	208.980 83 2-8-18-18-5	84	(209) 84 2-8-18-18-6	85	(210) 85 2-8-18-18-7	86	(222) 86 2-8-18-18-8
7	87	(223) 87 2-8-18-18-8-1	88	226.025 88 2-8-18-18-8-2	89	227.028 89 2-8-18-18-9-2	104	(261) 104	(262) 105	(263) 106	(264) 107	(265) 108	(266) 109	(269) 110	(272) 111	(277) 112																				

**KEY**

Atomic Mass → 12.011 ← Selected Oxidation States

Symbol → **C**

Atomic Number → 6

Electron Configuration → 2-4

Relative atomic masses are based on <sup>12</sup>C = 12.000

**Note:** Mass numbers in parentheses are mass numbers of the most stable or common isotope.

\*\*Denotes the presence of (2-8-) for elements 72 and above

\*The systematic names and symbols for elements of atomic numbers above 109 will be used until the approval of trivial names by IUPAC.

140.12 58	140.908 59	144.24 60	(145) 61	150.36 62	151.96 63	157.25 64	158.925 65	162.50 66	164.930 67	167.26 68	168.934 69	173.04 70	174.967 71
232.038 90	231.036 91	238.029 92	237.048 93	(244) 94	(243) 95	(247) 96	(247) 97	(251) 98	(252) 99	(257) 100	(258) 101	(259) 102	(260) 103



# WHO AM I?

These mystery elements are waiting to be identified. The trick is—you'll need the Periodic Table to unmask their identities. Unless you have it memorized, you'll need a copy of the table from your science book or from page 52 of this book. Read the clues about each mystery element, figure out what it is, and then write the name and symbol of the element.

1. Nonmetal halogen family atomic mass 35

2. 25 electrons transition element

3. gas 48 neutrons

4. period 2 atomic mass 11

5. nonmetallic period 3 atomic mass 32

6. 26 protons period 4 transition element

7. 12 neutrons metallic 11 electrons

8. 29 electrons period 4

9. atomic mass 20 gas

10. period 5 transition element 51 neutrons

11. 80 electrons transition element

12. period 4 lowest mass in period

13. metallic period 4 20 electrons

14. period 6 gas 86 protons

15. 4 neutrons metallic

16. period 4 metallic 27 electrons

17. metallic period 6 56 protons

18. gas atomic mass 16 8 neutrons

19. mass less than 30 not neon noble gas

20. period 5 metallic 38 electrons

**REMEMBER:**

*The Atomic number equals the number of protons. Atomic mass equals the number of protons plus neutrons. The number of electrons equals the number of protons.*

- |           |           |
|-----------|-----------|
| 1. _____  | 11. _____ |
| 2. _____  | 12. _____ |
| 3. _____  | 13. _____ |
| 4. _____  | 14. _____ |
| 5. _____  | 15. _____ |
| 6. _____  | 16. _____ |
| 7. _____  | 17. _____ |
| 8. _____  | 18. _____ |
| 9. _____  | 19. _____ |
| 10. _____ | 20. _____ |

Name \_\_\_\_\_

**Protons, Neutrons, and Electrons Practice Worksheet**

**Directions:** Complete the chart by finding the atomic number, atomic mass, protons, neutrons, and electrons.

<b>Atomic symbol</b>	<b>Atomic number</b>	<b>Protons</b>	<b>Neutrons</b>	<b>Electrons</b>	<b>Mass Number</b>	<b>Atomic Mass</b>
B			6			
	11				24	
		31	37			
				39	89	
			35			63.5
		43			100	
Pb					207	
			102	70		
					225	227
Mo			53			
	81				206	
	100		159			
No					261	
Tm					170	
		106	159			
					22	20.2
				19	39	
	2		2			
Ti					49	
			30			55.8
		4	5			
				16	32	
V			28			

Name \_\_\_\_\_  
 Period \_\_\_\_ Date \_\_\_\_/\_\_\_\_/\_\_\_\_

## 2 • Atomic Structure & Nuclear Chemistry

### ATOMIC NUMBER & MASS NUMBER

Complete the following chart and answer the questions below. *HINT: The number that appears after the element name in the first column is the mass number.*

	<i>Element Name</i>	<i>Atomic Number</i>	<i>Number of Protons</i>	<i>Number of Neutrons</i>	<i>Mass Number</i>
1.	carbon – 12				12
2.		8		8	
3.	hydrogen – 1				1
4.			6		14
5.	hydrogen – 3			2	
6.	nitrogen – 14				14
7.				1	2
8.		92		146	
9.	cesium – 137			82	
10.		11		12	
11.			47		108
12.	tungsten – 184			110	
13.				45	80
14.			24		52
15.				89	152
16.	silver – 107				107
17.		76		114	

18. How are the *atomic number* and the *number of protons* related to each other?
19. How do the *number of protons*, *number of neutrons*, and the *mass number* relate to each other?
20. What is the *one thing* that determines the identity of an atom (that is, whether it is an oxygen atom or a carbon atom, etc.)?



## Broughton High School of Wake County

Name \_\_\_\_\_ Date \_\_\_\_\_

**Atomic Structure**

An atom is composed of protons, neutrons, and electrons. The protons and neutrons are found in the nucleus of the atom. The electrons are found in the electron cloud, which is an area that surrounds the nucleus.

A standard periodic table of elements can provide you with a great deal of insight into the composition of an atom. The atomic number is equal to the number of protons. The mass number is equal to the number of protons and neutrons. In a neutral atom, the number of protons and electrons are equal. When an atom is in a charged state (ion), the charge indicates the imbalance between protons and electrons. Too many electrons produces a negative charge, too few electrons results in a positive charge.

Example:

$O^{2-}$  Mass Number = 16 Atomic Number = 8  8 protons, 8 neutrons (16-8), 10 electrons (8+2)	<b>Explanation:</b>  Protons = Atomic Number Neutrons = Mass Number – Atomic Number Electrons = Charge (+/-) Proton Number.
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Complete the following chart.

Element or Ion	Atomic Number	Mass Number	# of Protons	# of Neutrons	# of Electrons
Li		7			
Ba <sup>+2</sup>		137			
Al <sup>+3</sup>		27			
F <sup>-</sup>		19			
Br		80			
Ru <sup>+3</sup>		101			
Cr <sup>+2</sup>		52			
S <sup>-2</sup>		32			
Si		28			
C		12			
P <sup>-3</sup>		31			

