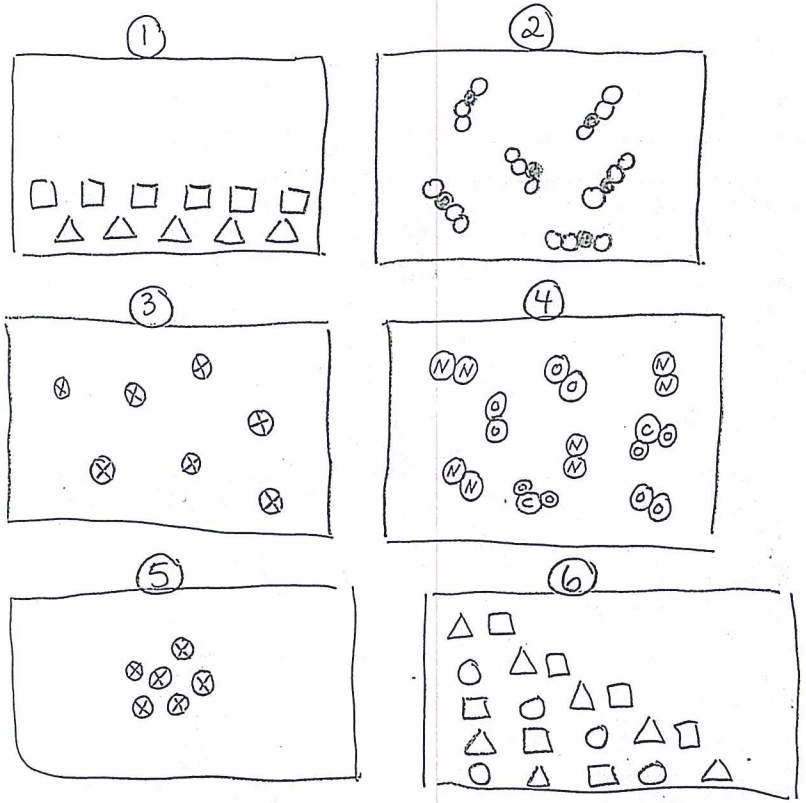


Use the numbers to describe the above.

pure substances	3,5,2	looks like gas	3, 4
elements	3,5	looks solid	5
mixtures	6,4,1	compound	2
homogeneous mixture	4	Can be drawn using Bohr-Rutherford Diagrams	3,5
heterogeneous mixture	6,1?		

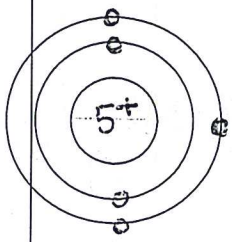
What evidence of a chemical change was observed when:

Calcium chloride & H_2O were mixed	Heat
Fluoresine & H_2O mixed	Color
Energy balls were smacked together	Odor
Birthday Candle was lit	Gas, Odor, Color
Alkaseltzer was placed in H_2O	Gas
Straw was blown into Lime water	~~Precipitate~~
Lemon water dried on paper was heated	color

Atomic Basics Name _____

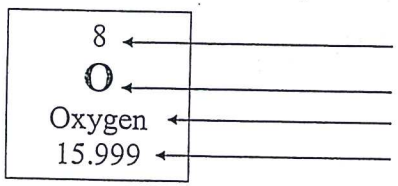
Part A: Atomic Structure

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? Boron



Part B: Atomic Calculations

6. Label the information provided in the periodic table.



7. What does the atomic number represent?
#protons or #e⁻

8. What does the atomic mass represent?
#p⁺ + #n⁰

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

10. How would you figure the number of neutrons in an atom? Subtract mass # & Atomic #

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

Element	Atomic Number	Atomic Mass	Protons	Neutrons	Electrons
Li	3	7	3	4	3
P	15	31	15	16	15
Cl	17	35	17	18	17
Ni	28	59	28	31	28
K	19	39	19	20	19
Ag	47	108	47	61	47
H	1	1	1	0	1
Si	14	28	14	14	14
W	74	184	74	110	74
Ne	10	20	10	10	10

Part C: Electron Configuration

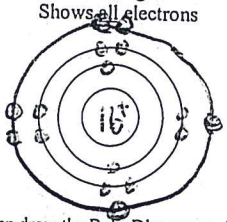
12. How many electrons can each level hold? 1st = 2 2nd = 8 3rd = 8

13. What term is used for the electrons in the outermost shell or energy level? valence

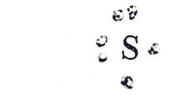
14. Scientists use two types of diagrams to show the electron configuration for atoms. Follow your teacher's directions to complete the diagrams.

Sulfur
Atomic # = 16
Atomic Mass = 32
Protons = 16
Neutrons = 16
Electron = 16

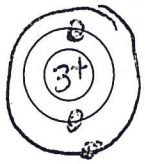
Bohr Diagram
Shows all electrons



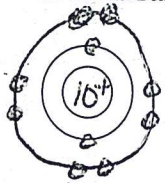
Lewis Structure
Shows valence electrons



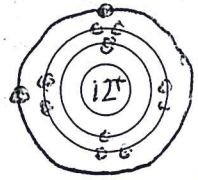
15. Calculate the missing information and then draw the Bohr Diagram and Lewis Structure for each element.



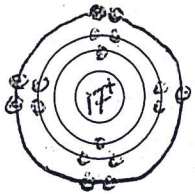
Li
Atomic # = 3
Mass # = 7
# of P = 3
# of N = 4
# of E = 3



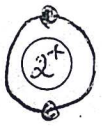
Ne
Atomic # = 10
Mass # = 20
# of P = 10
# of N = 10
# of E = 10



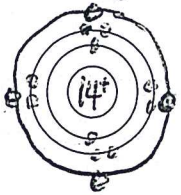
Mg
Atomic # = 12
Mass # = 24
# of P = 12
# of N = 12
# of E = 12



Cl
Atomic # = 17
Mass # = 35
# of P = 17
# of N = 18
# of E = 17



He
Atomic # = 2
Mass # = 4
# of P = 2
# of N = 2
# of E = 2



Si
Atomic # = 14
Mass # = 28
# of P = 14
# of N = 14
# of E = 14

16. Answer the questions below based on the elements in question #15.

(1) Which elements had a filled outermost shell? Ne He

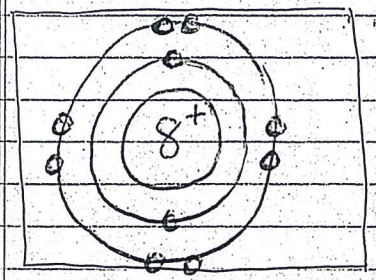
(2) Which element would be most likely to lose electrons in a chemical bond? Li

(3) Which element would be most likely to gain electrons in a chemical bond? Cl

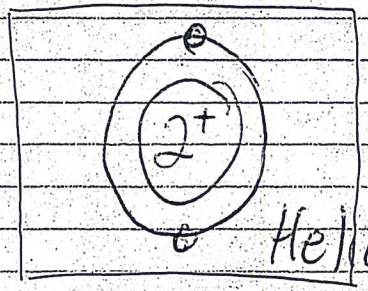
(4) Which elements are not likely to bond with other elements? Ne He Why? Outer shell = FULL

Living in a Material World

Draw the Bohr-Rutherford diagram of:



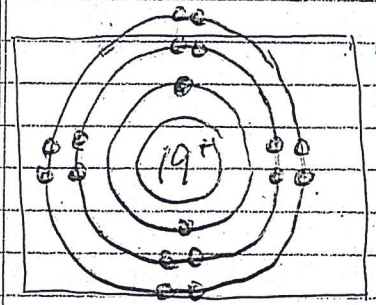
O^{2-}



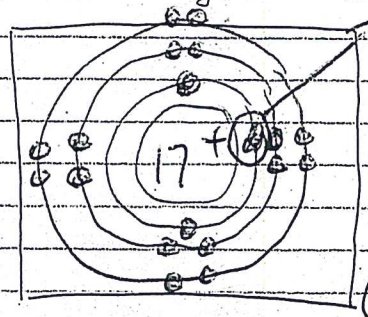
Helium

the atom in the 1st period with a full electron shell

Draw the Bohr-Rutherford diagram of:



K^+



ignore this

Chlorine

Cl^-

the hallogen in the 3rd period when it becomes a negative ion

Period Table Worksheet 1

1. While doing a research project, you noted the following information about five elements.

Element A :
- is a solid;
- conducts electricity;
- has 2 electrons in its outermost shell;
- has a low density.

Alkaline Earth Metal

Element B :
- is not malleable
- does not conduct electricity;
- has 7 electrons in its outermost shell;
- is light green in colour.

Nonmetal Halogen

Element C :
- has all its outer orbits full
- does not form compounds with other elements;
- is in a gaseous state;
- has a very low boiling point.

Element D :
- is a poor conductor of heat;
- is very hard;
- in non-ductile and non-malleable;
- conducts electricity.

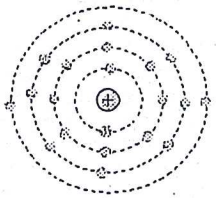
Metaloid

Element E :
- is ductile and malleable;
- is a solid;
- is a good conductor of heat and electricity;
- has a high melting point.

Metal

Classify the elements above as metals, non-metals or metalloids.

2. The simplified atomic model of an element is shown below.



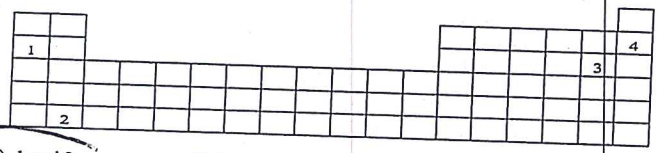
What are, respectively, the Group and the Period of the Periodic Table to which the element belongs?

A) IIA and 4 B) II A and 3 C) IV A and 2 D) IV A and 3

2 valence

4 shells

3. Which of the elements in the table below possess the properties of **shininess, electrical conductivity and malleability?**

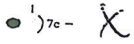
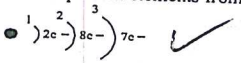
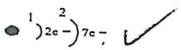
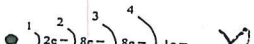


A) 1 and 2 B) 1 and 4 C) 2 and 3 D) 3 and 4

4. In a laboratory, a scientist noted the following facts about an element:
   1. It is a solid.
   2. It is a poor conductor of heat and electricity
   3. The nucleus of the atom of this element contains less than 18 protons.
   4. The outermost electron shell contains 5 electrons.

   What is this element? Phosphorus

5. Which of the following atomic models represent elements from the halogen family?

1.  X
3.  ✓
2.  ✓
4.  X

A) 1 and 2 B) 3 and 4 C) 2 and 3 D) 1 and 4

6. After a forest fire, we collected the ashes that were left on the ground. An analysis of these ashes enabled us to determine their composition. The table below lists the different elements that were found.

NAME OF ELEMENT	CHEMICAL SYMBOL
Calcium	Ca
Chloride	Cl
Iron	Fe
Magnesium	Mg
Phosphorus	P
Potassium	K
Silicon	Si
Sodium	Na
Sulphur	S

a) Choose two elements that are found in the same period in the periodic table of the elements. Explain your choice by using scientific concepts.

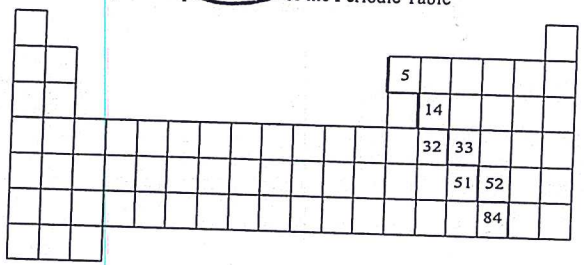
K & Ca both have 4 electron shells

b) Choose two elements that are found in the same group in the periodic table of the elements. Explain why these elements have the same chemical reactivity using the Rutherford-Bohr model.

BAD QUESTION

7. Complete the following sentence by choosing the correct response. Fluorine, chlorine, bromine and iodine belong to the halogen family; they are all used for.
   A) Lightning B) Disinfecting C) Communication D) Heating

8. Below is a partial representation of the Periodic Table



Using the table above, which of the following statements best describes the location of metals, non-metals and metalloids?

A) The non-metals are situated in the seven boxes identified. The metals occupy the region to the right of these boxes and the metalloids the region to the left.
B) The metals are situated in the seven boxes identified. The metalloids occupy the region to the right of these boxes and the non- metals the region to the left
C) The metalloids are situated in the seven boxes identified. The non-metals occupy the region to the right of these boxes and the metals the region to the left.
D) The metalloids are situated in the seven boxes identified. The metals occupy the region to the right of these boxes and the non-metals the region to the left.

9. Listed below are the characteristics of an element from the periodic table.
   - It is a nonmetal.
   - Its outermost energy level has seven electrons.
   - It is used to purify and disinfect water.

   To which group in the periodic table does this element belong?
   A) Alkali metals B) Alkaline earth metals C) Halogens D) Inert gas

10. The organization of the Periodic Table can be explained in terms of electron arrangements. Which of these explanations is correct?
A) An element that immediately precedes a noble gas always has its last electron in a new energy level. This means that the element is in a new Period.
B) An element that immediately follows a noble gas always has its last electron in a new energy level. This means that the element is in a new Period

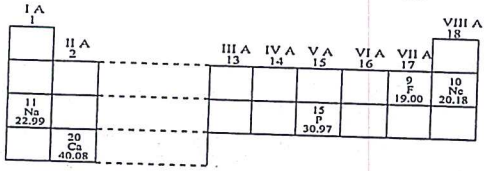
C) An element that immediately follows a noble gas always has its last electron in the same energy level as the preceding noble gas. This means that the element is in a new Period

D) An element that immediately follows a noble gas always has its last electron in a new energy level. This means that the element is in the same Period.

11. Give the name of each element described below.

1. The element has electrons in two energy levels (shells) and the outer level is full. Neon
2. The element has electrons in three energy levels (shells) and it has two valence electrons. Mg
3. The element has an atomic number of 14. Silicon
4. The element reacts vigorously with water and the electric charge of its nucleus is +19.

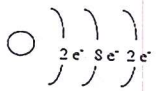
12. Five elements are identified in the following periodic table. K



Match each of the five elements with one of the characteristics listed below

1. Its third energy level contains 5 valence electrons. P
2. It is a gas that does not react with metals or nonmetals. Ne
3. It is an element whose chemical reactions are similar to those of potassium. Na
4. It is one of the most corrosive gases. F
5. It is an alkaline earth metal that is a component of bones and teeth. Ca

13. The following diagram shows the Rutherford-Bohr model of an atom.



Using the periodic table answer the following questions:

a) To what group does this element belong? Alkaline Earth Metals

b) To what period does this element belong? 3

14. The following table gives some information about four elements (E_1, E_2, E_3 and E_4).

Element	Protons	Electrons
E_1	19	
E_2		18
E_3	12	
E_4		9

Which of these elements is an alkaline earth metal?

A) Element E_1 B) Element E_2 C) Element E_3 D) Element E_4

15. The chemical symbols of four elements are given in the table below. Fill the table.

ELEMENT	NUMBER OF VALENCE ELECTRONS	CHEMICAL FAMILY NAME
Br	7	Halogen
Ca	2	Alkaline Earth
Na	1	Alkali
Ne	8	Noble

16. The table below gives the chemical symbols of four elements and provides space to indicate the following characteristics: the number of valence electrons, the number of energy levels, chemical reactivity (none, low or high) and the family number. Using the periodic table, fill in the blank boxes in the table.

Element Symbol	Number of Valence Electrons	Number of Energy Levels	Chemical Reactivity	Family Number
Li	1	2	high	Alkali
C	4	2		14
Cl	7	3		Halogen
Ne	8	2	x	Noble

group

17. The table below provides certain information about the symbol, the electron configuration, the name of the chemical family and the period number of four elements in the periodic table.

Symbol	Electron configuration	Name of the chemical family	Period number
Mg	⊕ 2e⁻)8e⁻)2e⁻	Alkaline Earth	3
Li	⊕)2e⁻)1e⁻	Alkali metals	2
B	•)2e⁻)3e⁻	metaloid	2
He	•)2e⁻	Noble	1

Using the above information and the periodic table, fill in the empty boxes in the table

18. The following are statements about certain elements in the periodic table. Which statement is true?

A) Nitrogen (N) is a noble gas located in period 5.
B) Bromine (Br) is a halogen located in period 4. ✓
C) Hydrogen (H) is an alkali metal located in period 1
D) Magnesium (Mg) is an alkaline earth metal located in period 2.

19. An element in the halogen family has four electron shells. What is the name of this chemical element?

A) Beryllium B) Bromine C) Iodine D) Potassium

Atomic Model and Periodic Table Test Review

A. Give the family name for each description.

1. I have 1 electron on my outer shell. alkali Metals
2. One of the elements has 35 protons. halogens
3. I have 2 electrons on my outer orbit. Alkaline Earth metals
4. We are unreactive stable elements. Noble
5. I can be used as a disinfectant. Halogens
6. I have 1 valence electron. ~~Alkali Metals~~

B. What element is described for each statement?

1. I am found in period 2 and have 3 valence electrons. B
2. I am found in family III A and use 3 orbitals. Al
3. I have 20 protons. Ca
4. I have 2 energy levels and each is full. Ar
5. I am a metalloid with three energy levels. Si
6. I am an inert gas and have 1 energy level. He
7. I do not have a group I belong to. H
8. I have a +3 charge and 3 energy levels. Al
9. I have a -2 charge and 4 orbits. Se

C. State whether the following are metals, non-metals or metalloids.

Element A	Malleable	Conducts electricity	Not ductile	metaloid
Element B	Conducts heat	Reacts with acids	Shiny	metal
Element C	3 states of matter	Accepts electrons	No conduction	non-metal

D. True of False

1. Elements in the same period have the same number of valence electrons. F
2. Elements in the same group have the same number of valence electrons. T
3. Aluminum is a metalloid. F
4. Na, Mg and Al all have the same number of energy levels. T
5. Cl has three valence electrons. F
6. Li and Be have the same number of ions. F
7. Mg has a charge of +2. T

E. Make a Lewis notation and give the ion for each element

	Li	He	N	F	Be	Ar
Lewis	$Li\cdot$	$He:$	$\cdot\ddot{N}\cdot$	$:\ddot{F}\cdot$	$\cdot Be\cdot$	$:\ddot{Ar}:$
Ion	Li^+	X	N^{3-}	F^-	Be^{2+}	X

no ions exist for these... Why?

F. Multiple Choice

1. The study of the behaviour of matter has made it possible to develop simple models such as the Bohr-Rutherford model of the atom. If the atomic number of oxygen is 8 and its mass number is 16, which diagram represents the oxygen atom according to the Bohr-Rutherford model?

A) 8 p, 2e - 6e

C) 16 p, 6e - 2e

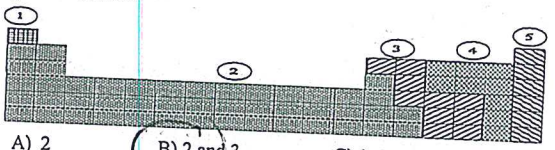
B) 8 p, 8e

D) 8 p, 16e

2. When Rutherford carried out his famous gold foil experiment, he noticed that very few alpha particles were deflected back at an angle greater than 90°.
Which of the following statements is NOT consistent with this observation?
A) The atom is mostly empty space.
B) The nucleus is very small.
C) The nucleus has a positive charge.
D) Electrons move in orbitals.

3. After performing tests on several elements, you note that some of them have the following properties :
   1. They are ductile and malleable.
   2. They are good conductors of electricity.
   3. They react with acids.

In which region (1, 2, 3, 4 or 5) of the periodic table below are the elements with all these three properties located?



A) 2 B) 2 and 3 C) 1, 2 and 3 D) 4 and 5

4. Which of the following cannot be a property of a metal?
A) It conducts electricity
B) It reacts to acids
C) It has metallic luster
D) It has a low melting point

5. Consider the five elements given in the simplified periodic table below.

IA 1	IIA 2	IIIA 13	IVA 14	VA 15	VIA 16	VIIA 17	VIIIA 18
	2					4	
1			3				5

Which of the following statements is completely true?

A) Element 1 is an alkali metal and element 5 is a chemically active gas.
B) Element 1 is an alkali metal and element 4 is a metal.
C) Element 2 is an alkaline earth metal and element 3 is a metalloid.
D) Element 4 is a halogen and can combine chemically with element 5.

6. Consider the four elements shown in the simplified periodic table below.

Li	Be																

Which of the following statements is completely true?

A) Lithium (Li) is an alkaline earth metal, and beryllium (Be) is an alkali metal.
B) Chlorine (Cl) is an inert gas, and argon (Ar) is a halogen.
C) Lithium (Li) is an alkali metal, and argon (Ar) is an inert gas.
D) Beryllium (Be) is an alkali metal, and chlorine (Cl) is a halogen.

7. The table below shows eight elements from the periodic table.

												B	C	N			
												Al	Si	P			
														Sb	Te		

Which of the following groups of elements consists of metalloids only?

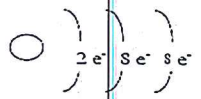
A) Al, N, Sb and Te
B) Al, C, P and Si
C) B, N, P and Te
D) B, Sb, Si and Te

8. An element in the halogen family has four electron shells. What is the name of this chemical element?

A) Beryllium
B) Bromine
C) Iodine
D) Potassium

G. Short Answer

1. The following diagram shows the Rutherford-Bohr model of an atom.



Using the periodic table answer the following questions:

a) To what group does this element belong? Noble
b) To what period does this element belong? 3
c) What is the name of this element? Argon
d) What is its charge? No chg
e) Make a Lewis notation for this element. :Ar:

2. The chemical symbols of four elements are given in the table below. Fill the table.

Element	Number of valence electrons	Family name	Number of orbits	Ion charge
Br	7	halogen	4	Br^-
Ca	2	alkaline Earth	4	Ca^{2+}
Na	1	alkali	3	Na^+
Ne	8	Noble	2	Ne

3. Only do number three if you have time.
You are given a sample of the first 12 elements (A to L) of the periodic table. Each element is identified by a characteristic written on its label. The following information is what you read on the labels. Which element is identified by each label? You must use process of elimination until all 12 elements are found.

Unknown elements A- L	Characteristic	Element
Element A	Has 5 protons	B
Element B	Is an inert gas	~~Ne~~ Ne
Element C	Has 8 electrons	~~O~~ O
Element D	Is an alkaline earth element	Be
Element E	Can place its electrons in two energy levels	Li
Element F	Has 2 valence electrons and a complete outermost energy level	~~He~~ He
Element G	An alkali metal	Li
Element H	The most reactive metal from the 12 first elements	Na
Element I	Has an atomic number of 12	Mg
Element J	It is found in the carbon family	C
Element K	Is a halogen	F
Element L	The only element which does not belong to a group	H

Name:_____ Period:_____

Isotope Practice

1. Here are three isotopes of an element: $^{12}_{6}C$ $^{13}_{6}C$ $^{14}_{6}C$
   a. The element is: Carbon
   b. The number 6 refers to the proton #
   c. The numbers 12, 13, and 14 refer to the mass #
   d. How many protons and neutrons are in the first isotope? 6 & 6
   e. How many protons and neutrons are in the second isotope? 6 & 7
   f. How many protons and neutrons are in the third isotope? 6 & 8
2. Complete the following chart:

Isotope name	atomic #	mass #	# of protons	# of neutrons	# of electrons
Potassium-37	19	37	19	18	19
Oxygen-17	8	17	8	9	8
uranium-235	92	235	92	143	92
uranium-238	92	238	92	146	92
boron-10	5	10	5	5	5
boron-11	5	11	5	6	5

1. What is an isotope? , An atom that has varieties of neutron #s
2. What does the number next to isotopes signify? mass #
3. How can you tell isotopes of the same element apart mass #

PART II. For each of the following isotopes, write the number of protons, neutrons, and electrons. Assume all atoms are neutral.

	Chromium-58	Chromium-63
# of protons	24	24
# of neutrons	34	39
# of electrons	24	24

	Carbon-12	Carbon-13	Carbon-14
# of protons	6	6	6
# of neutrons	6	7	8
# of electrons	6	6	6

Name:_____ Per:_____

Ions Worksheet

Element	# Valence Electrons	# Electrons to gain	# Electrons to lose	Ion Formed/ name
Li	1	None	1	Li^{+1} / cation
N	5	3	None	N^{-3} / anion
O	6	2	—	O^{2-}
Ca	2	—	2	Ca^{2+}
Br	7	1	—	Br^{-}
S	6	2	—	S^{2-}
Cl	7	1	—	Cl^{-}
K	1	—	1	K^{+}
Mg	2	—	2	Mg^{2+}
Be	2	—	2	Be^{2+}

Questions:

1. If Li loses an electron to another atom, why is it written Li^{+1} (with a +1)?
2. If N gains 3 electrons from other atoms, why is it written N^{-3} (with a -3)?
3. a. What do you think happens to atomic radius size of a cation & why? b. an anion & why?

Name:_____ Per:_____

Ions Worksheet

Element	# Valence Electrons	# Electrons to gain	# Electrons to lose	Ion Formed/ name
Li	1	None	1	Li^{+1} / cation
N	5	3	None	N^{-3} / anion
O				
Ca				
Br				
S				
Cl				
K				
Mg				
Be				

Questions:

1. If Li loses an electron to another atom, why does it have a have a +1 charge?
2. If N gains 3 electrons from other atoms, why does it have a -3 charge?
3. a. What do you think happens to atomic radius size of a cation & why? b. an anion & why?

NAME _____ DATE _____

Ions Worksheet

Use your periodic table to fill in the missing spaces below.

Element	Atomic Number	Protons	Electrons	Group #	Valence Electrons	Cation or Anion?
Carbon	6	6	6	14	4	Both
Oxygen	8	8	8	16	6	A
Potassium	19	19	19	1	1	C
Arsenic	33	33	33	15	5	A
Iodine	53	53	53	17	7	A
Calcium	20	20	20	2	2	C
Boron	5	5	5	13	3	C
Neon	10	10	10	18	8	

For each of the following ions, indicate the total number of protons and electrons. When given the protons and electrons, indicate the ion with the correct charge.

Ion	Protons	Electrons	Protons	Electrons	Ion
Cl^{1-}	17	18	56	54	Ba^{2+}
K^{1+}	19	18	87	86	Fr^{+}
S^{2-}	16	18	84	86	Po^{2-}
Sr^{2+}	38	36	50	46	Sn^{4+}
Al^{3+}	13	10	32	36	Ge^{4-}
P^{3-}	15	18	55	54	Cs^{+}
Si^{4-}	14	18	12	10	Mg^{2+}

Use your periodic table to complete the table below. The first one has been done for you.

Element	Atomic #	Mass	Protons	Neutrons	Electrons	Symbol
Iodine	*53*	*127*	*53*	*74*	*54*	I^{1-}
Chlorine	17	35	17	18	18	Cl^{1-}
Hydrogen	1	1	1	0	0	H^{+}
Bromine	35	80	35	45	36	Br^{-}
Boron	5	11	5	6	2	B^{3+}
Oxygen	8	16	8	8	10	O^{2-}

	Nitrogen-15	Nitrogen-20
# of protons	7	7
# of neutrons	8	13
# of electrons	7	7

	Sulfur-23	Sulfur-25
# of protons	16	16
# of neutrons	7	9
# of electrons	16	16

	Sodium-12	Sodium-20
# of protons	11	11
# of neutrons	1	9
# of electrons	11	11

	Selenium-50	Selenium-55
# of protons	34	34
# of neutrons	16	21
# of electrons	34	34

Element	Atomic #	Mass	Protons	Neutrons	Electrons	Symbol
Nitrogen	7	14	7	7	10	N^{3-}
Aluminum	13	27	13	14	10	Al^{3+}
Fe	26	56	26	30	24	Fe^{2+}
Cu	29	64	29	35	28	Cu^{1+}
Cu	29	64	29	35	27	Cu^{2+}

Match each of the positive ions listed with the total number of electrons that ion contains. Use your periodic table. The same answer may be used more than once.

A) 2 B) 10 C) 21 D) 23 E) 24

F) 25 G) 36 H) 48 I) 76 J) 81

B Al^{+3} D Fe^{+3} B Mg^{+2} H Sn^{+2}

A Li^{+1} C Cr^{+3} G Rb^{+1} I Pt^{+2}