

Name _____ Hour _____

CHEMISTRY
CHAPTER 4 BIG IDEAS

For each BIG IDEA you must write at least 3 COMPLETE SENTENCES!

- 1. Explain the determining factor of an elements properties and how those properties can be located on the periodic table (p. 124-129)**
- 2. Describe the two types of Ions and explain how they are formed. (p. 131-133)**
- 3. Explain how the Formulas and Names of Ionic Compounds are written. (p. 134-135)**
- 4. Determine and describe the 3 main properties of an Ionic Compound. (p. 136)**

5. Explain how atoms are held together in a Covalent Bond and compare Simple, Double and Triple Bonds. (p. 139-140)

6. Describe a Molecular Compound and it's properties. (p. 141)

8. Describe the composition and structure of a Metal Crystal. (p. 147)

9. Summarize each of the 5 properties of metals. (p. 148-150)

Electron Dot Diagrams

The electrons in an atom's outer energy level are the electrons that are important to consider in chemical bonds and chemical reactions. These electrons can be represented in a diagram called an **electron dot diagram**. The outermost electrons are drawn as dots around the chemical symbol. In this activity, you will draw the electron dot diagrams for several elements.

Procedure:

1. Write the symbol for element. (Example: the symbol for chlorine is Cl)
2. Use the Periodic Table to determine how many outer electrons the element has. Do this by finding which group the element belongs to. (Chlorine belongs to Group 17, the Halogens which has 7 outer electrons)
3. Draw a dot to represent each electron in the outer level of the element. Two electrons can be placed on the right side of the symbol. The rest of the outer electrons should be distributed counterclockwise one by one around the other sides of the symbol.

The electron dot diagram for chlorine is: Cl

4. Write the electron dot diagrams for elements listed.

- | | |
|-------------|--------------|
| a. hydrogen | f. fluorine |
| b. neon | g. argon |
| c. sodium | h. potassium |
| d. calcium | i. krypton |
| e. aluminum | j. bromine |

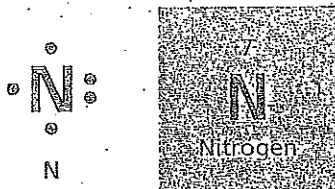
5. Why do sodium and potassium have the same number of dots in their electron dot diagrams? What does this tell you about the chemical properties of these two elements?

Review and Reinforce

Atoms, Bonding, and the Periodic Table

Understanding Main Ideas

Look at the diagram below. Then answer the following questions in the space provided.



1. How many protons does a nitrogen atom have? _____
2. How many valence electrons does a nitrogen atom have? _____
3. Is nitrogen reactive or stable? _____
4. Neon (Ne), which has an atomic number of 10 is in Group 18 in the periodic table. To which group does nitrogen belong? _____
5. The element directly below nitrogen in the periodic table is phosphorous (P). How many valence electrons does phosphorous have? _____
6. Will the properties of nitrogen be more similar to the properties of neon or the properties of phosphorous? Explain. _____

Building Vocabulary

If the statement is true, write *true*. If the statement is false, change the underlined word or words to make the statement true.

7. _____ An element's reactivity is determined by the number of protons found in an atom of the element.
8. _____ The force of attraction that holds two atoms together is called a chemical bond.
9. _____ In a(n) periodic table, dots around an element's symbol indicate the number of valence electrons in an atom.

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Lesson Quiz

Atoms, Bonding, and the Periodic Table

If the statement is true, write *true*. If the statement is false, change the underlined word or words to make the statement true.

- _____ An atom's valence electrons are those electrons that have the highest energy.
- _____ Atoms tend to be stable and nonreactive if they have six valence electrons.
- _____ In the periodic table, the number of valence electrons in each element decreases from left to right across each period.
- _____ The reactivity of a metal depends on how easily it loses its valence electrons.
- _____ Within each period in the periodic table, elements have similar properties because they have the same number of valence electrons.

Fill in the blank to complete each statement.

- The number of _____ in the atom of an element determines its chemical properties.
- The columns in the periodic table are called _____.
- A(n) _____ shows the number of valence electrons in an atom in pictorial fashion.
- The attractive force that holds two atoms together is called a(n) _____.
- Because it can either lose or share electrons when it combines with other elements, each _____ has some of the properties of metals and some of the properties of nonmetals.

Review and Reinforce

Ionic Bonds

Understanding Main Ideas

Fill in the blank to complete each statement.

1. Negative ions form when atoms _____ valence electrons.
2. In the formation of an ionic compound, a metal atom is most likely to _____ valence electrons.
3. Ionic compounds form because _____ charges attract.

Answer the following questions in the spaces provided. You may use a periodic table.

4. A potassium ion has a charge of $1+$. A sulfide ion has a charge of $2-$.
What is the chemical formula for potassium sulfide?

5. Name the following compound: MgO .

Building Vocabulary

Write a definition for each of these terms on a separate piece of paper.

6. ion
7. polyatomic ion
8. ionic bond
9. ionic compound
10. chemical formula

Lesson Quiz

Ionic Bonds

Write the letter of the correct answer on the line at the left.

- | | |
|--|--|
| <p>1. ___ Ionic bonds form between two ions that have</p> <p>A ionic compounds
B negative charges
C positive charges
D opposite charges</p> | <p>2. ___ Ions that are made of more than one atom are called</p> <p>A ionic compounds
B crystals
C polyatomic atoms
D ionic bonds</p> |
| <p>3. ___ Which is most likely to form a negative ion?</p> <p>A an element from Group 17
B a metal
C an element from Group 1
D an element with atoms that have eight valence electrons</p> | <p>4. ___ Which of the following is the correct name for $MgCl_2$?</p> <p>A magnesium chlorine
B magnesium dichlorine
C magnesium chloride
D magnesium dichloride</p> |

Fill in the blank to complete each statement.

5. A(n) _____ is an atom or group of atoms that has an electric charge.
6. The attraction between oppositely charged ions is called a(n) _____.
7. When an atom loses a valence electron, it becomes a(n) _____ ion.
8. In order to have a stable arrangement of 8 valence electrons, metal atoms are likely to _____ electrons.
9. In an ionic compound, the total positive charge of all the positive ions _____ the total negative charge of all the negative ions.
10. Because the force of attraction between the positive and negative ions is so strong, ionic compounds have _____ melting points.

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

Name _____ Hour _____

Flame Test For METALS Lab

Prior Knowledge: (RESTATE with complete sentences)

1. What colors are visible in a fireworks display?
2. How do you think the different colors that you see in the sky are produced?
3. What kind of materials are used to make fireworks?

Hypothesis: (RESTATE with complete sentences)

4. Which element in each compound are we testing in the flame (metal or non-metal)?
5. What evidence do you have to support your idea?

Procedure:

Step 1: Check that your lab station has beakers A-I of pre-mixed compounds.

Step 2 : Break four wooden splints in half and place one piece in each of the beakers. Allow them all to soak for at least 2-3 minutes.

Step 3: Place each splint, one at a time in the flame of the Bunsen burner and record the color of the flame in the chart below & the next page:

Step 4: Clean up your lab area and neatly arrange the equipment for the group.

Beaker	Name of Compound	Flame Color	Compounds written out with correct symbols & subscripts
A	Potassium chloride		
B	Lithium chloride		
C	Calcium chloride		
D	Unknown		
E	Copper Sulfate		
F	Sodium bicarbonate		

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Beaker	Name of Compound	Flame Color	Compounds written out with correct symbols & subscripts
G	Strontium chloride		
H	Barium chlorate		
I	Magnesium chloride		

6. Identify the following:

Independent Variable (What did you change?) _____

Dependent Variable (What resulted from that change?) _____

Controls (What was kept the same?) _____

7. Based on your test results, was your answer to question #4 the correct? If not, what evidence changed your opinion?

8. What can be hypothesized based on the color results?

9. Based on your hypothesis, what element must solution D contain?

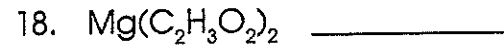
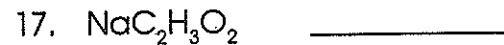
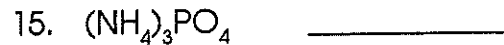
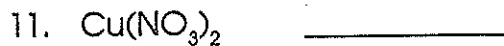
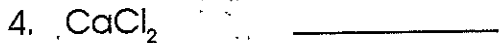
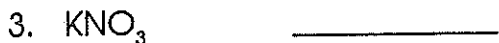
10. What were some possible errors that could have occurred AND what could have been done to improve the accuracy of this lab?

11. What was the purpose of this lab?

NUMBER OF ATOMS IN A FORMULA

Name _____

Determine the number of atoms in the following chemical formulas.



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Naming IONIC BONDS.

Write out the name of the Metal first followed by the Non-Metal. **Change the ending of the Non-Metal to an -ide.**

















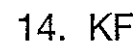


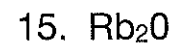


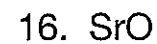


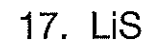








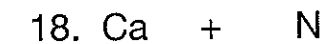
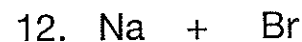
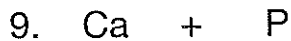






Writing out Ionic Bond Formulas:

- A. Look up the oxidation numbers (charges)
B. Combine the elements into a neutral formula using subscripts



NAMING BINARY COMPOUNDS (IONIC)

Name _____

Name the following ionic compounds using Roman numerals where necessary.

- | | | | |
|----------------------------|-------|-----------------------------|-------|
| 1. BaCl_2 | _____ | 11. K_2S | _____ |
| 2. NaF | _____ | 12. CrCl_2 | _____ |
| 3. Ag_2O | _____ | 13. CrCl_3 | _____ |
| 4. CuBr | _____ | 14. CaO | _____ |
| 5. CuBr_2 | _____ | 15. Ba_3P_2 | _____ |
| 6. FeO | _____ | 16. Hg_2I_2 | _____ |
| 7. Fe_2O_3 | _____ | 17. Na_2O | _____ |
| 8. MgS | _____ | 18. BeS | _____ |
| 9. Al_2O_3 | _____ | 19. MnO | _____ |
| 10. CaI_2 | _____ | 20. Mn_2O_3 | _____ |

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SUBSTANCE	PREDICTION (CONDUCTS) YES OR NO	ACTUAL (CONDUCTS) YES OR NO	IONIC or COVALENT BOND?
COFFEE			
IVORY SNOW			
WATER			
GATORADE			
WINDEX			
DISH SOAP			
SALT (NaCl)			
RUBBING ALCOHOL			
BAKING SODA			
EPSOM SALT			
SUGAR			
PICKLE JUICE			
LEMON JUICE			

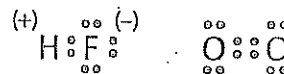
Review and Reinforce

Covalent Bonds

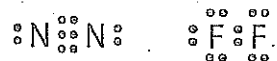
Understanding Main Ideas

Answer the following questions in the spaces provided. Use the diagram at right to answer questions 1-5.

1. Circle all of the covalent bonds in the electron dot diagrams.



2. Which bond(s) shown are double bonds?



3. Which bond(s) shown are triple bonds?

_____ **SKIP**

4. Which molecule(s) shown have polar bonds?

_____ **SKIP**

5. Compare and contrast O₂ and F₂.

Building Vocabulary

Match each term with its definition by writing the letter of the correct definition in the right column on the line beside the term in the left column.

6. ___ molecule

a. the chemical bond formed when two atoms share electrons

7. ___ double bond **SKIP**

b. a neutral group of atoms joined by covalent bonds

8. ___ nonpolar bond **SKIP**

~~c. a bond in which electrons are shared unequally~~

9. ___ polar bond

~~d. a bond in which electrons are shared equally~~

10. ___ covalent bond

e. a bond in which four electrons are shared.

Lesson Quiz

Covalent Bonds

Write the letter of the correct answer on the line at the left.

1. ___ In an electron dot diagram, two pairs of shared electrons represents a
A single bond
B double bond
C triple bond
D quadruple bond
2. ___ A nitrogen molecule (N_2) has one triple bond. How many electrons do the nitrogen atoms share?
A 1
B 3
C 4
D 6
3. ___ Compared to ionic compounds, molecular compounds generally have
A good conductivity
B greater densities
C more chemical bonds
D a low boiling point
4. ___ Compared to ionic compounds, molecular compounds generally have
A stronger chemical bonds
B poor conductivity
C a high melting point
D lower densities

If the statement is true, write *true*. If the statement is false, change the underlined word or words to make the statement true.

5. _____ The chemical bond formed when two atoms share electrons is called a(n) ionic bond.
6. _____ Covalent bonds usually form when a nonmetal combines with a(n) metal.
7. _____ A(n) ion is a neutral group of atoms joined by covalent bonds.
8. SKIP _____ If a molecule contains polar bonds, the molecule may or may not be polar overall.
9. SKIP _____ In a(n) polar bond, one atom pulls on the shared electrons more than the other atom.
10. _____ The forces between molecules are much stronger than the forces between ions.

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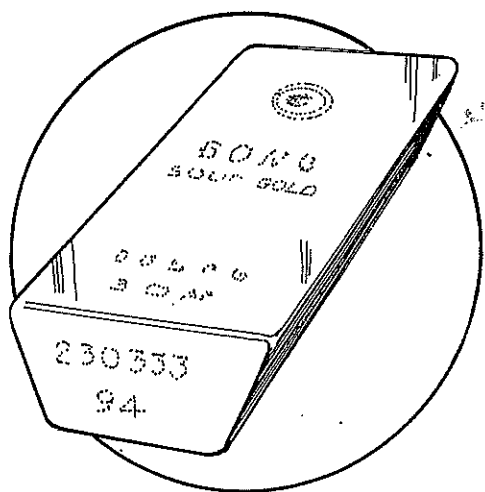
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TYPES OF CHEMICAL BONDS

Name _____

Classify the following compounds as ionic (metal and nonmetal), covalent (nonmetal and nonmetal) or both (compound containing a polyatomic ion).

1. CaCl_2 _____
2. CO_2 _____
3. H_2O _____
4. BaSO_4 _____
5. K_2O _____
6. NaF _____
7. Na_2CO_3 _____
8. CH_4 _____
9. SO_3 _____
10. LiBr _____



11. MgO _____
12. NH_4Cl _____
13. HCl _____
14. KI _____
15. NaOH _____
16. NO_2 _____
17. AlPO_4 _____
18. FeCl_3 _____
19. P_2O_5 _____
20. N_2O_3 _____

Polyatomic Ion	Charge
Hydroxide-OH	1 ⁻
Nitrate - NO ₃	1 ⁻
Sulfate - SO ₄	2 ⁻
Carbonate-CO ₃	2 ⁻
Acetate- C ₂ H ₃ O ₂	1 ⁻
Phosphate-PO ₄	3 ⁻
Chlorate-ClO ₃	3 ⁻
Ammonium-NH ₄	1 ⁺
Dichromate-Cr ₂ O ₇	2 ⁻

Prefixes for Naming Compounds

Number of Atoms	Prefix
1	mono-
2	di-
3	tri-
4	tetra-
5	penta-

(18)

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NAMING BINARY COMPOUNDS (COVALENT)

Name _____

Name the following compounds using the prefix method.

1. CO _____
2. CO₂ _____
3. SO₂ _____
4. NO₂ _____
5. N₂O _____
6. SO₃ _____
7. CCl₄ _____
8. NO _____
9. N₂O₅ _____
10. P₂O₅ _____
11. N₂O₄ _____
12. CS₂ _____
13. OF₂ _____
14. PCl₃ _____
15. PBr₅ _____

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NAMING OF NON-BINARY COMPOUNDS

Name _____

An ionic compound that contains more than two elements must contain a polyatomic ion. Name the following compounds.

1. NaNO_3 _____
2. Ca(OH)_2 _____
3. K_2CO_3 _____
4. NH_4Cl _____
5. MgSO_4 _____
6. AlPO_4 _____
7. $(\text{NH}_4)_2\text{SO}_4$ _____
8. Na_3PO_4 _____
9. CuSO_4 _____
10. NH_4OH _____
11. Li_2SO_3 _____
12. $\text{Mg(NO}_3)_2$ _____
13. Al(OH)_3 _____
14. $(\text{NH}_4)_3\text{PO}_4$ _____
15. KOH _____
16. $\text{Ca(NO}_3)_2$ _____
17. K_2SO_4 _____
18. Pb(OH)_2 _____
19. Na_2O_2 _____
20. CuCO_3 _____

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NAMING COMPOUNDS (MIXED)

Name _____

Name the following compounds.

1. NaCl _____
2. MnS _____
3. K₂O _____
4. CuBr₂ _____
5. CuBr _____
6. CO₂ _____
7. PbSO₄ _____
8. Li₂CO₃ _____
9. Na₂CO₃ _____
10. NO₂ _____
11. N₂O₄ _____
12. Ca(OH)₂ _____
13. NH₄Cl _____
14. SO₃ _____
15. AlPO₄ _____
16. CCl₄ _____
17. CaS _____
18. NH₃ _____
19. MgI₂ _____
20. K₃PO₄ _____

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IONIC AND COVALENT PROPERTIES EXPERIMENT

PROBLEM

Which of the following substances are ionic or covalent: sodium carbonate, mystery powder #1, corn starch and mystery powder #2?

BACKGROUND

Chemical compounds are combinations of atoms held together by chemical bonds. These chemical bonds are of two basic types: ionic and covalent. Ionic bonds result when one or more electrons from one atom or group of atoms are transferred to another atom. Positive and negative ions are formed. In covalent compounds the electrons are shared by the bonded atoms.

In this experiment, you will conduct tests on the properties and compile data enabling you to classify compounds as ionic or covalent.

MATERIALS

medicine droppers, Bunsen burner, conductivity tester, sodium carbonate, mystery powder #1, corn starch and mystery powder #2, and 4 test tubes

PROCEDURE

A - Description: record a detailed description of each substance in your data table.

B - Solubility: Place one scoop of powder into a clean test tube. Fill halfway with water and gently shake the test tube for 1 minute. Record your whether or not the substances dissolve in water. (**MAX 1 MINUTE**)

C - Conductivity: Your amazing and humble science teacher will test each of the substances for their ability to conduct electricity.

D - Melting Point: Record the amount of time (in seconds) that it takes for each compound to melt on Tin Foil. (**MAX 30 SECONDS**)

PRE-LAB QUESTIONS

1. Define the terms below using your Chemistry Book glossary:

covalent bonds:

ionic bonds:

2. Describe three general properties that ionic and covalent compounds below:

(use science book p. 136 & 141)

IONIC

COVALENT

3. Data Table

POWDER	Description (list at least two observations about each)	Melting Point (in seconds) 30sec< High 30sec> Low	Solubility (in seconds) 1min< High 1min> Low	Conducts electrical current (yes or no)	Ionic or Covalent?
Corn Starch					
Sodium Carbonate					
Mystery Powder #1					
Mystery Powder #2					

Name _____

Hour _____

“Don't be inSALTed” Lab

Background: pH is the percentage of hydrogen in a substance. If a substance has a large amount of Hydrogen (H⁺), low amount of Hydroxide (OH⁻) it is typically an acid. If it has a high amount of Hydroxide (OH⁻) and low amount of Hydrogen (H⁺) it is a base.

Question: If an acid and a base are combined what is the final compound and resulting pH?

Hypothesis: If an acid and base are combined, the final compound will be a _____ and the pH will be _____.

Materials: Glass flask, plastic beaker, plastic graduated cylinder, pH strips, baking soda/water mixture, vinegar

Directions: (Groups of 4)

1. Pour 10ml of vinegar into the plastic graduated cylinder. Describe the vinegar, measure the pH and indicate the color of the pH strip and number.
2. Pour 30ml of baking soda/water mixture into the plastic beaker. Describe the baking soda/water and indicate the color of the pH strip and number.
3. Carefully pour both liquids together. Describe the reaction and the resulting substance. Measure the pH.
4. Rinse out all of your containers and hang them on the black drying racks above the sinks.

SUBSTANCE	OBSERVATION/DESCRIPTION	COLOR/pH number
Vinegar		
Baking Soda		
Vinegar + Baking Soda		

Read the top of p. 223 in your science book. Describe the product of a neutralization reaction.

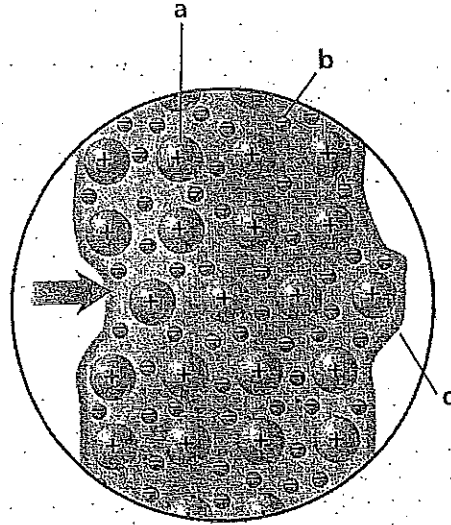
Complete a LAB REPORT using your LAB REPORT Template.

Review and Reinforce

Bonding in Metals

Understanding Main Ideas

Use the diagram to answer the following questions on a separate sheet of paper.



1. What do points *a* and *b* represent?
2. What action is modeled by the diagram? Explain.
3. How does metallic bonding explain the result at point *c*?

Match each property of metal with its description by writing the letter of the correct description in the right column on the line beside the property in the left column.

- | | |
|--------------------------------|---|
| 4. ___ luster | a. easily beaten into complex shapes |
| 5. ___ ductility | b. conducts electric current well |
| 6. ___ malleability | c. shiny and reflective |
| 7. ___ thermal conductivity | d. easily bent and pulled into thin strands |
| 8. ___ electrical conductivity | e. conducts heat well |

Building Vocabulary

On a separate sheet of paper, write a definition for each of these terms.

9. metallic bond
10. alloy

Lesson Quiz

Bonding in Metals

Write the letter of the correct answer on the line at the left.

1. ____ Why are alloys generally used to make everyday objects?
 - A Alloys are often stronger and less reactive than pure metals.
 - B Alloys have higher melting points than pure metals.
 - C Alloys are less expensive to produce than pure metals.
 - D Alloys have ionic bonds instead of metallic bonds.

2. ____ Metallic bonding is
 - A a type of covalent bond
 - B a type of ionic bond
 - C an attraction between positive and negative ions
 - D an attraction between positive ions and electrons

3. ____ Which of the following is NOT a property of metals?
 - A ductile
 - B good electrical conductor
 - C good thermal insulator
 - D malleable

4. ____ At room temperature, most metals are
 - A liquid
 - B solid
 - C gas
 - D an alloy

Fill in the blank to complete each statement.

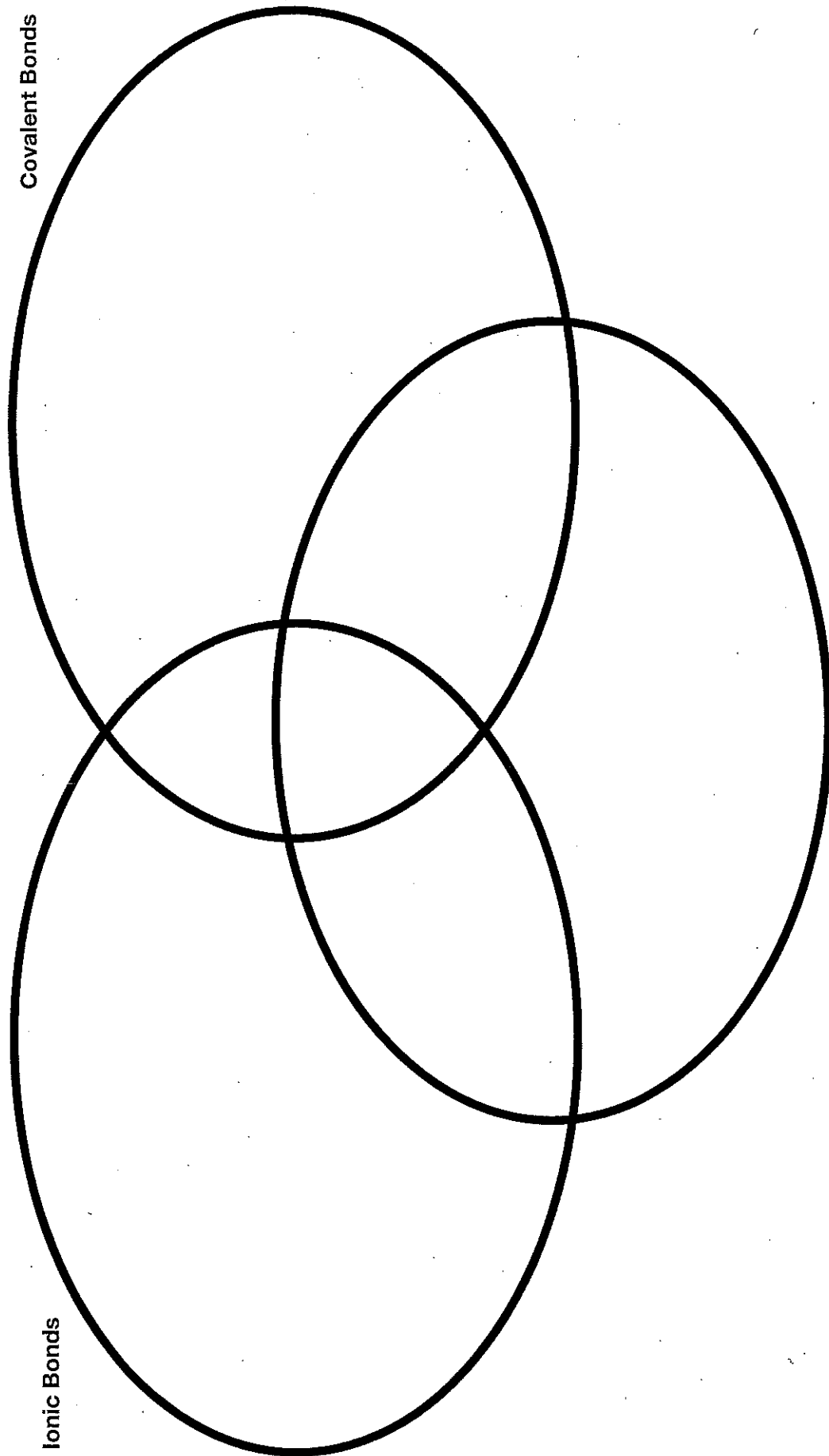
5. An attraction between a positive metal ion and surrounding electrons is a(n) _____ bond.
6. Metals typically have _____ melting points.
7. The metal fins that cool a motorcycle's engine make use of the high _____ conductivity of metals.
8. Metals are often used to make wire because they are _____.
9. Metals are used in electrical wires because they have high _____ conductivity.
10. Nonmetals are unlikely to form metallic bonds because their _____ are strongly held.

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Covalent Bonds

Ionic Bonds

Metallic Bonds



Enrich

Atoms, Bonding, and the Periodic Table

Read the passage, look at the diagram, and study the table. Then use a separate sheet of paper to answer the questions that follow.

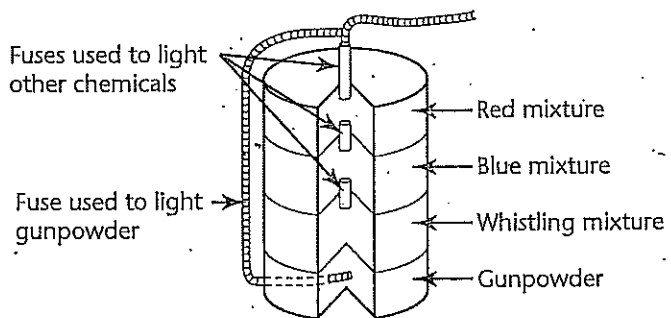
The Rockets' Red Glare

The basic fireworks unit is called a shell, and it is packed with chemicals that produce light, smoke, and noise when they burn. The effects depend on which chemicals are packed into the shell and how they are arranged.

A simple shell is shown at the right. When the gunpowder is at the bottom of the shell is lit, it explodes and lifts the shell into the air.

By the time the shell has reached the high point of its path, a second fuse ignites the other chemicals. Some shells explode all at once. Others are made of smaller shells that burst apart and explode separately. Time delays can be used to make a shell explode in stages.

The table below lists some chemicals and the effects they produce.



Element	Effect
strontium or lithium	red color
barium	green color
copper	blue color
sodium	yellow color
magnesium or aluminum	white color
potassium or sodium	whistling sound
potassium and sulfur	white smoke

1. To which groups of the periodic table do the majority of the elements listed in the table above belong? Why do you think elements in these groups are used in making fireworks?
2. Which group of elements could you not use in making fireworks? Explain your answer.
3. Why would you want to have two or more separate fuses in a rocket?
4. Solutions of magnesium, barium, and strontium are clear and colorless. Predict what might happen if a drop of each solution was held in the flame of a lab burner.

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FORMULAS WITH POLYATOMIC IONS

Name _____

Matching the horizontal and vertical axes, write the formulas of the compounds with the following combination of ions. The first one is done for you.

	OH^-	NO_3^-	CO_3^{2-}	SO_4^{2-}	PO_4^{3-}
H^+	HOH (H_2O)	HNO_3	H_2CO_3	H_2SO_4	H_3PO_4
Na^+					
Mg^{+2}					
NH_4^+					
Ca^{+2}					
K^+					
Al^{+3}					
Pb^{+4}					

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CHEMISTRY CH. 4 TEST (FIND SOMEONE WHO)

Name _____

- Instructions:**
1. I find someone with their hand up
 2. I ask a question from the list below
 3. My partner answers
 4. I write down answer
 5. My partner checks answer and signs their name.

<i>FIND SOMEONE WHO...</i>	<i>ANSWER</i>	<i>INITIALS</i>
1. Can write the formula and name for Mg (+2) and Cl (-1)		
2. Knows the result of an atom when it loses an electron. (Metals are....)		
3. Can identify the kind of bond that occurs when electrons are shared.		
4. Can write the formula for Copper (II) and Sulfate . (use Polyatomic Ions chart)		
5. Is able to draw the electron dot diagrams for He, Xe and F .	He Xe F	
6. Knows the names of the following two covalent compounds: N₂O₂ CCl₄		
7. Can write the formula and name for K (+1) and S (-2)		
8. Is able to describe the basic conductivity, boiling and melting points for all covalent bonds .		
9. Knows the sum of the oxidation numbers (charges) in a neutral compound.		
10. Can identify the amount of pairs of electrons that are shared between single, double and triple covalent bonds.	Single = Double = Triple =	
11. Can describe two differences between Ionic and Covalent Bonds.		