|  |  |
| --- | --- |
| # correct |  |
| Total #?’s |  |
| **GRADE** |  |

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

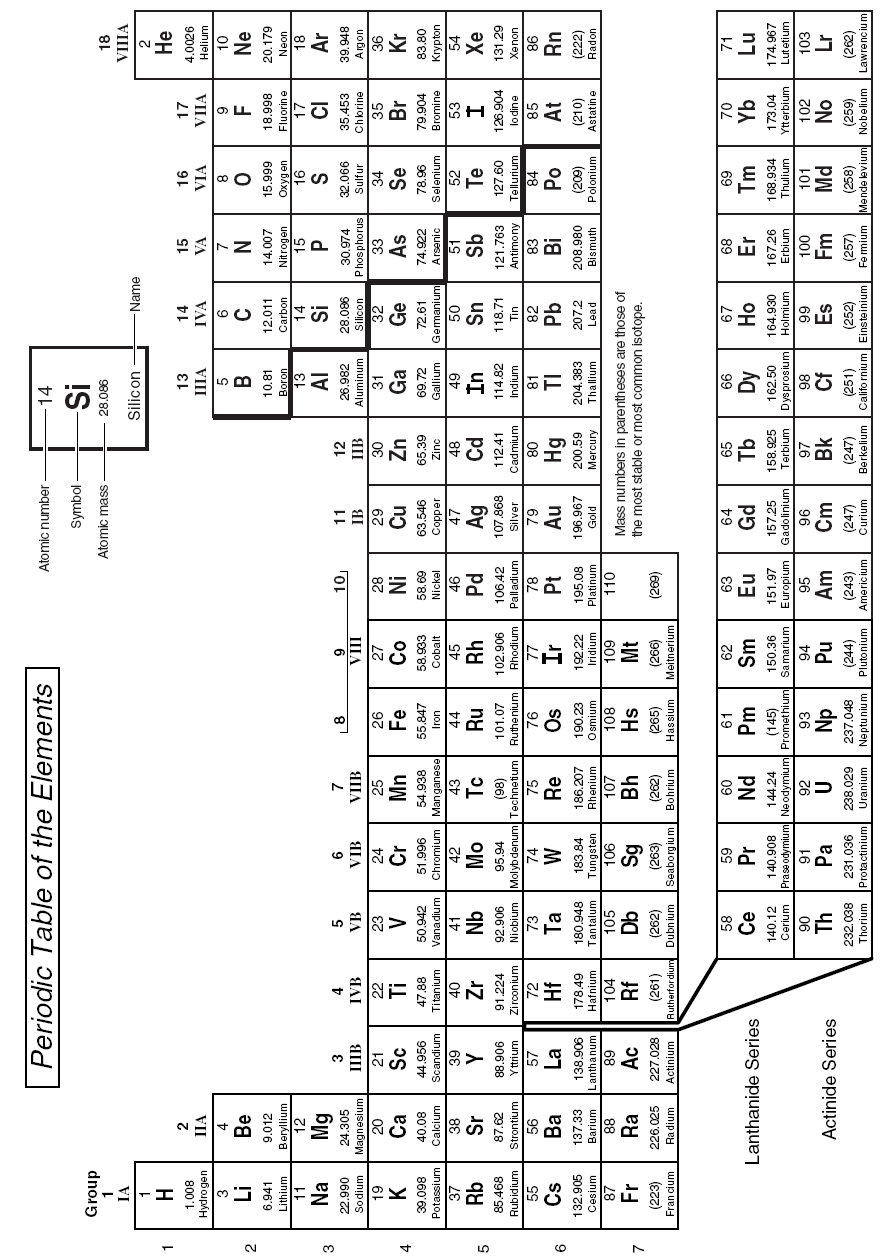
**Physical & Chemical changes**

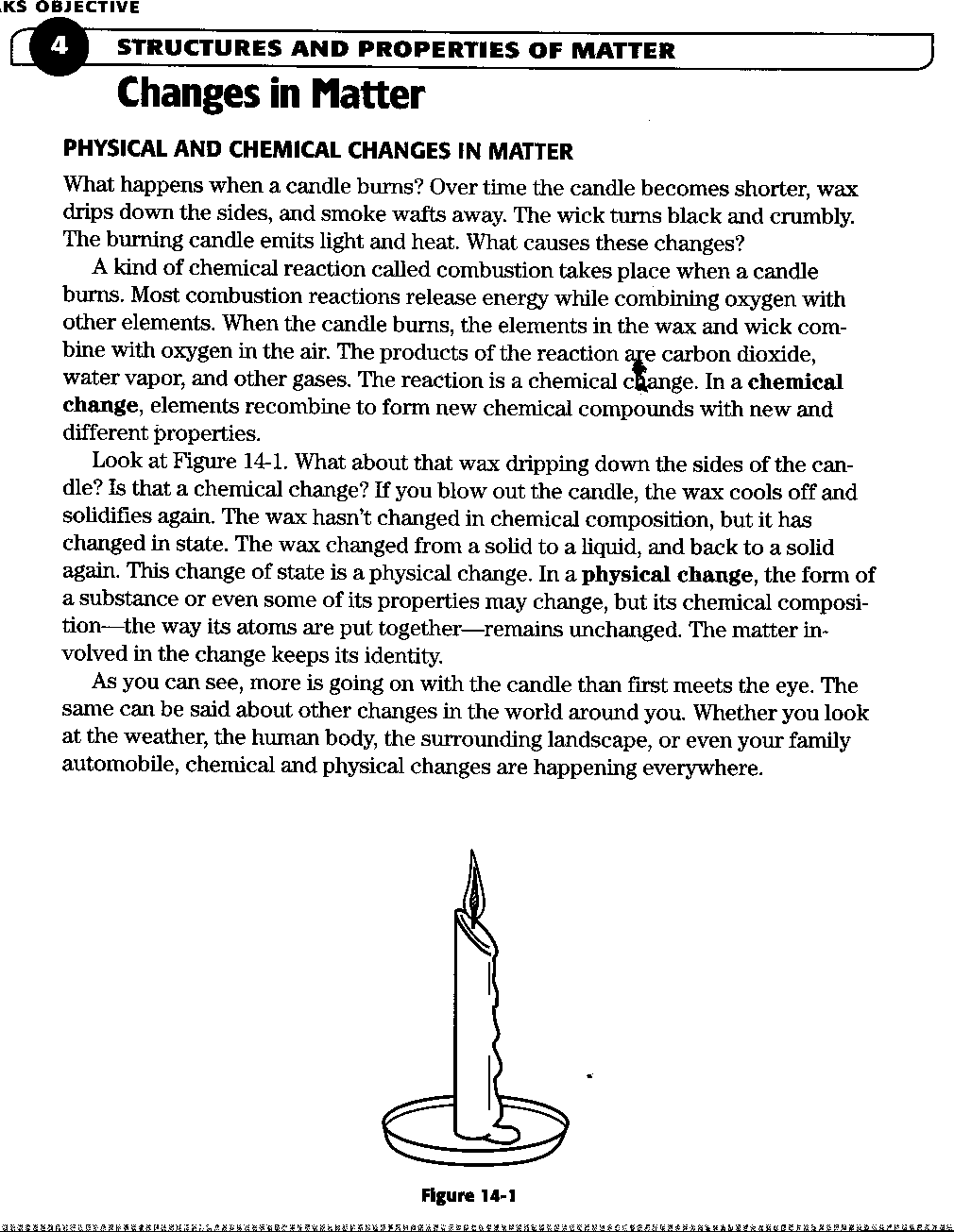
**Chemical Bonding**

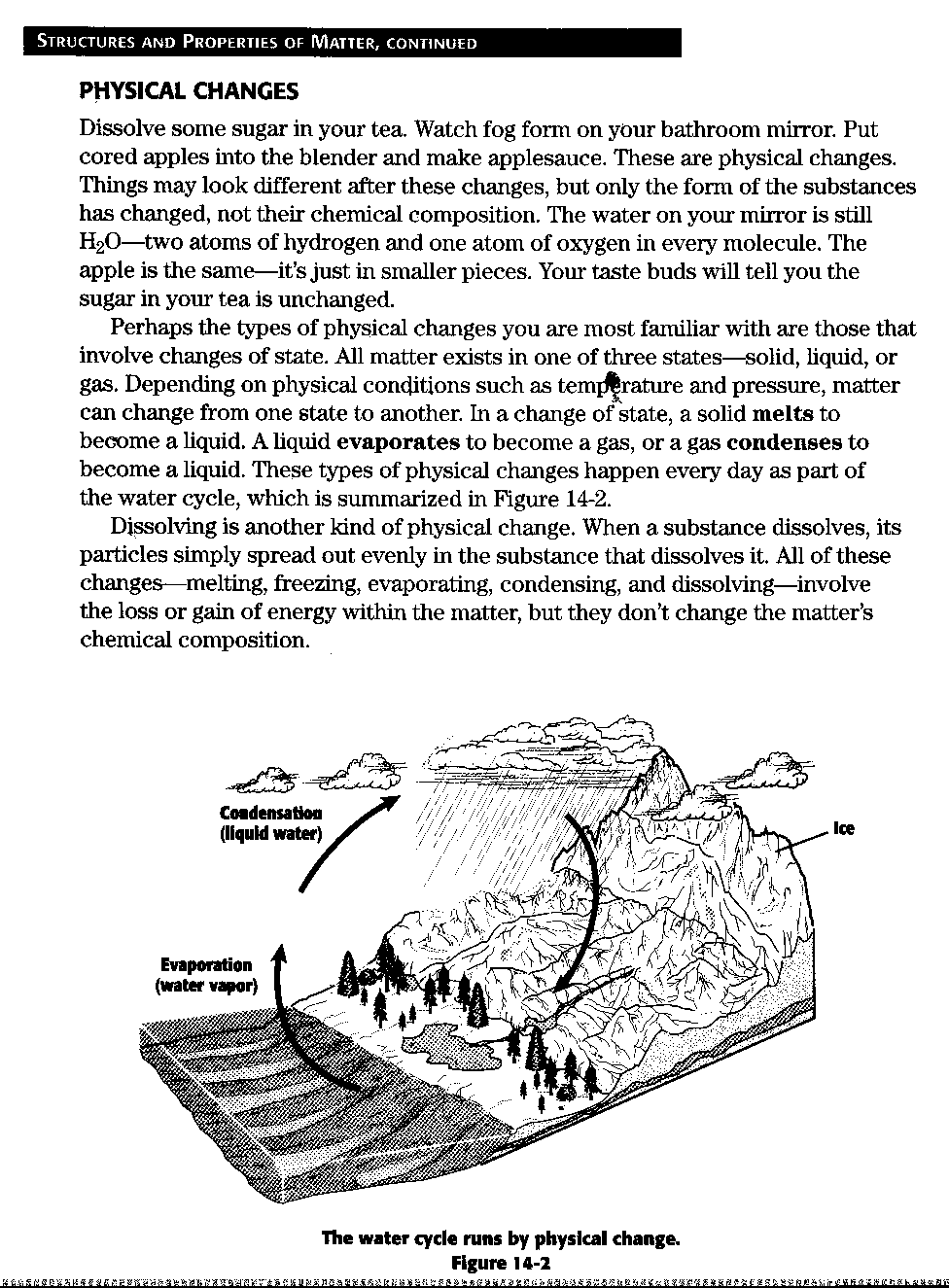
**Balancing Equations**

Unit 3

Student Manual



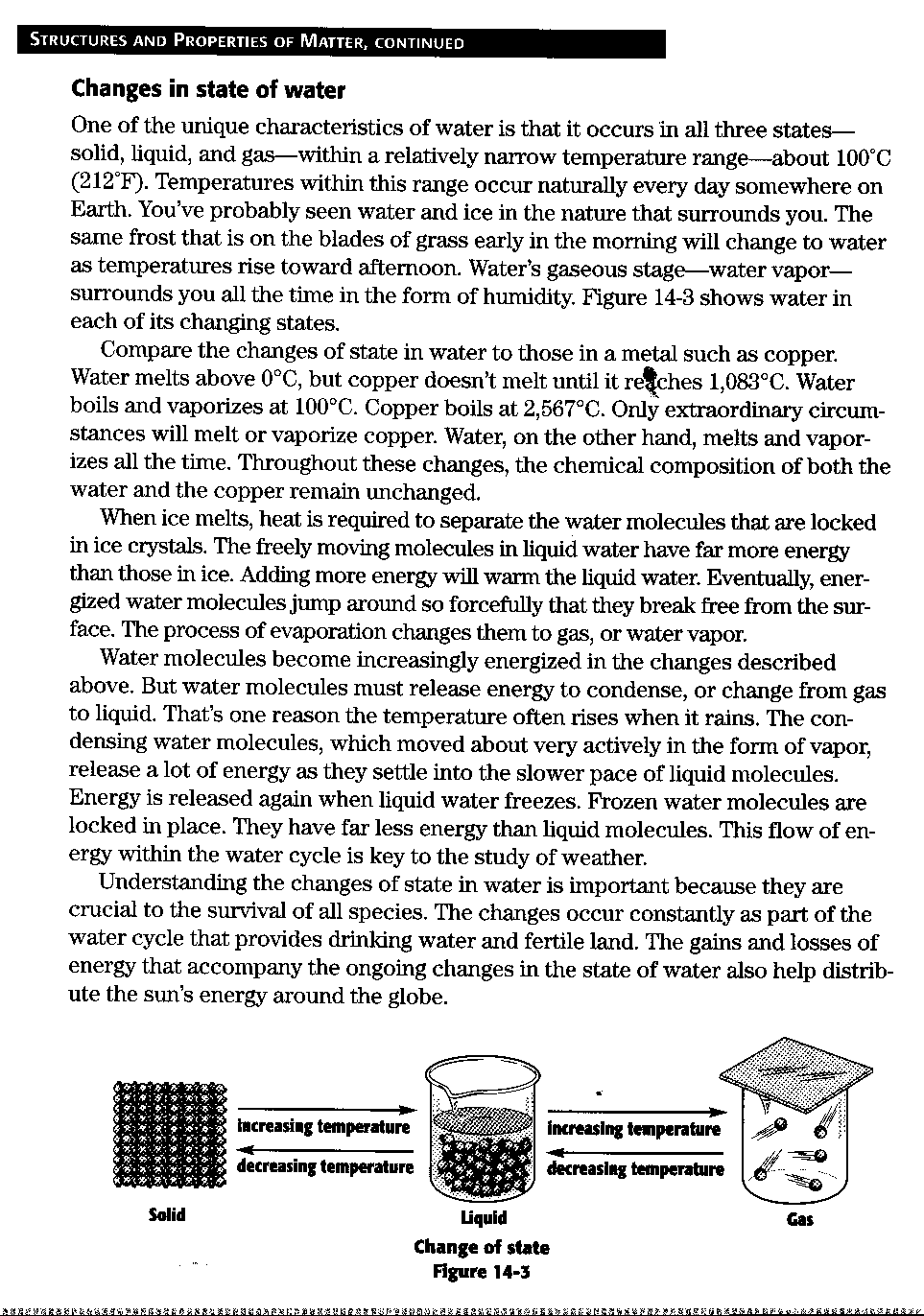




**Physical and Chemical Changes in Matter Questions**

*Read the preceding pages and answer the questions in complete sentences*

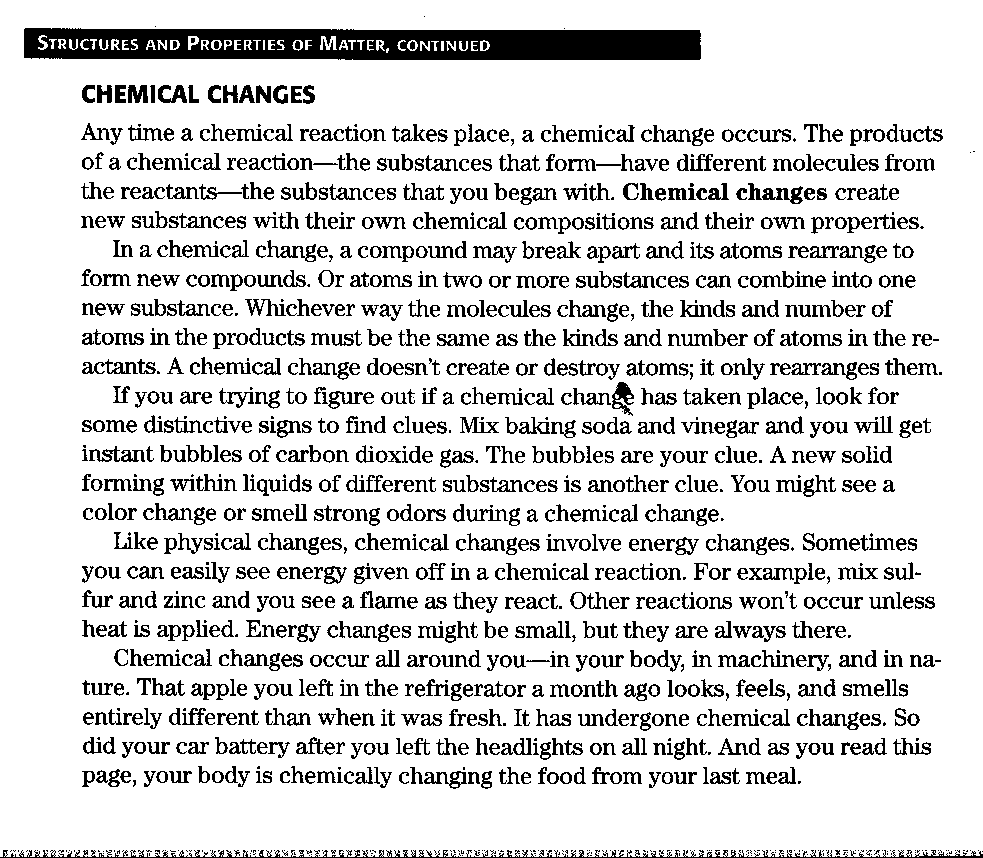
1. What products are produced when burning a candle?
2. What happens when a chemical changes takes place?
3. Compare a chemical change and a physical change.
4. Where do chemical changes occur?
5. What is dissolving?
6. What does physical changes involve?



Changes in State of Water

*Read the preceding page and answer the following questions in complete sentences*

1. What do we call water in each of its states?
2. At what temperature does water change from one state to another?
3. How does ice change to steam?
4. What role does energy lay in water changing its state?



1. What is a chemical change?
2. What happens in a chemical change?
3. What are some indicators that a chemical change is taking place?
4. What role does energy play in a chemical change?

**Reactions of Matter**

*Decide whether the changes listed below are chemical or physical. Write your answer in the blank provided.*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Dissolving sugar in coffee

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Burning coal

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mining coal

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Boiling an egg

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Boiling water

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Heating an iron nail

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Adding food coloring to water

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Dipping blue litmus paper in lemon juice

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Dissolving carbon dioxide in water

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Adding vinegar to baking soda to form CO2

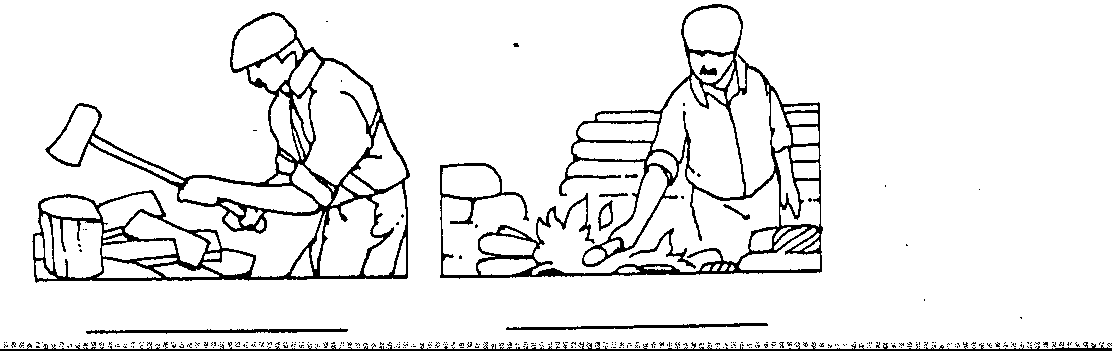
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mixing salt and pepper

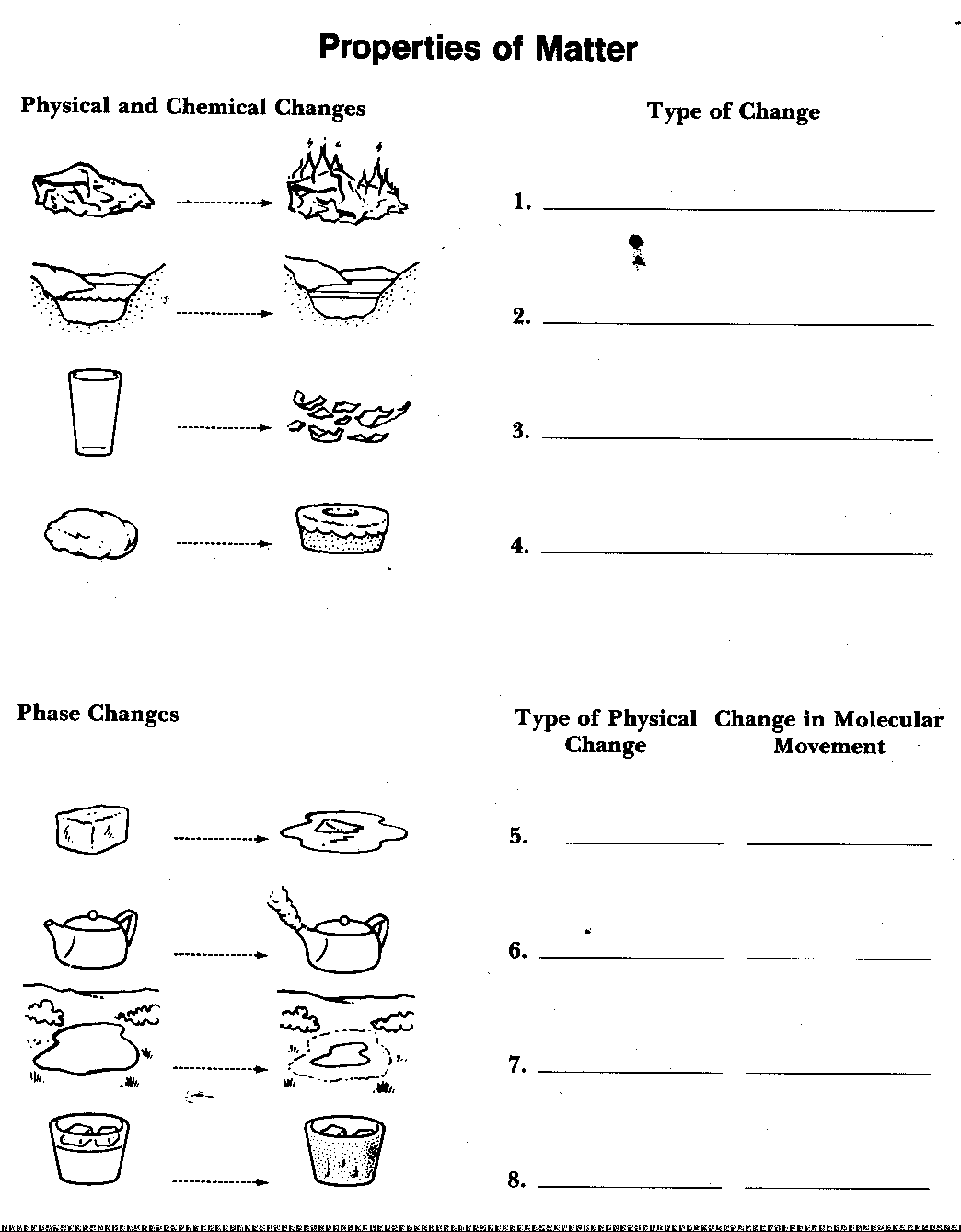
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mixing lye and hydrochloric acid

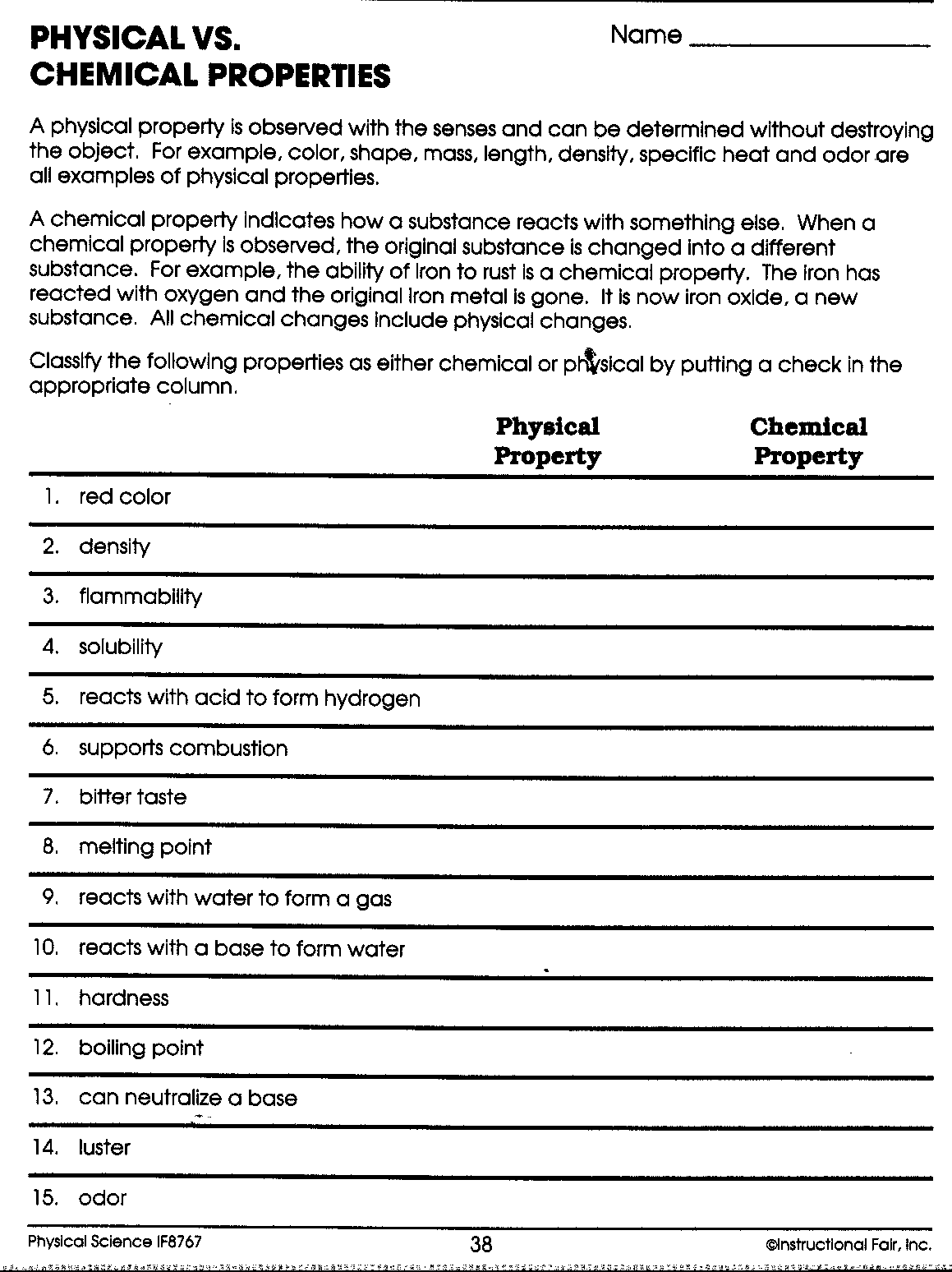
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Melting a nail

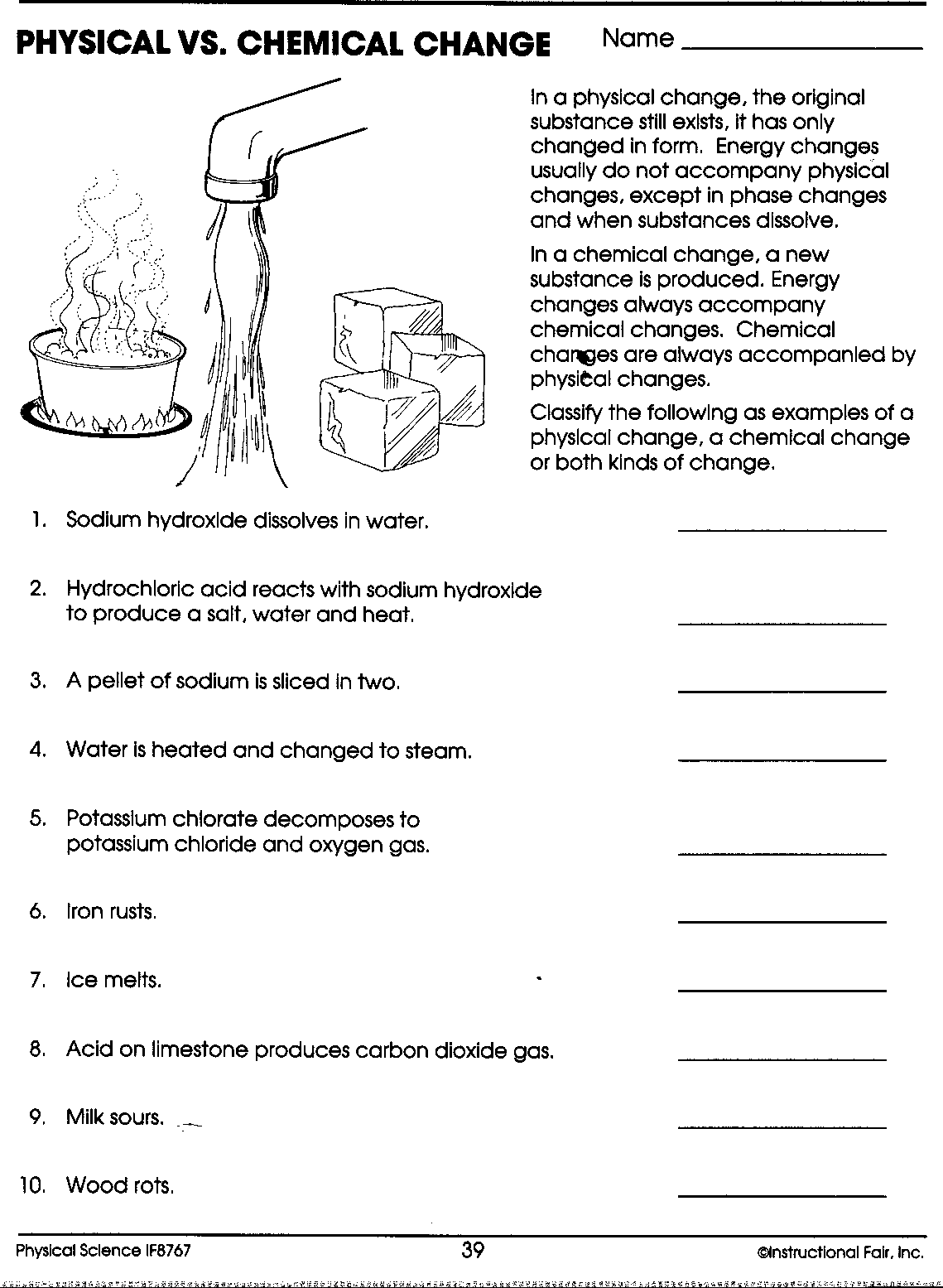
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Letting a nail rust

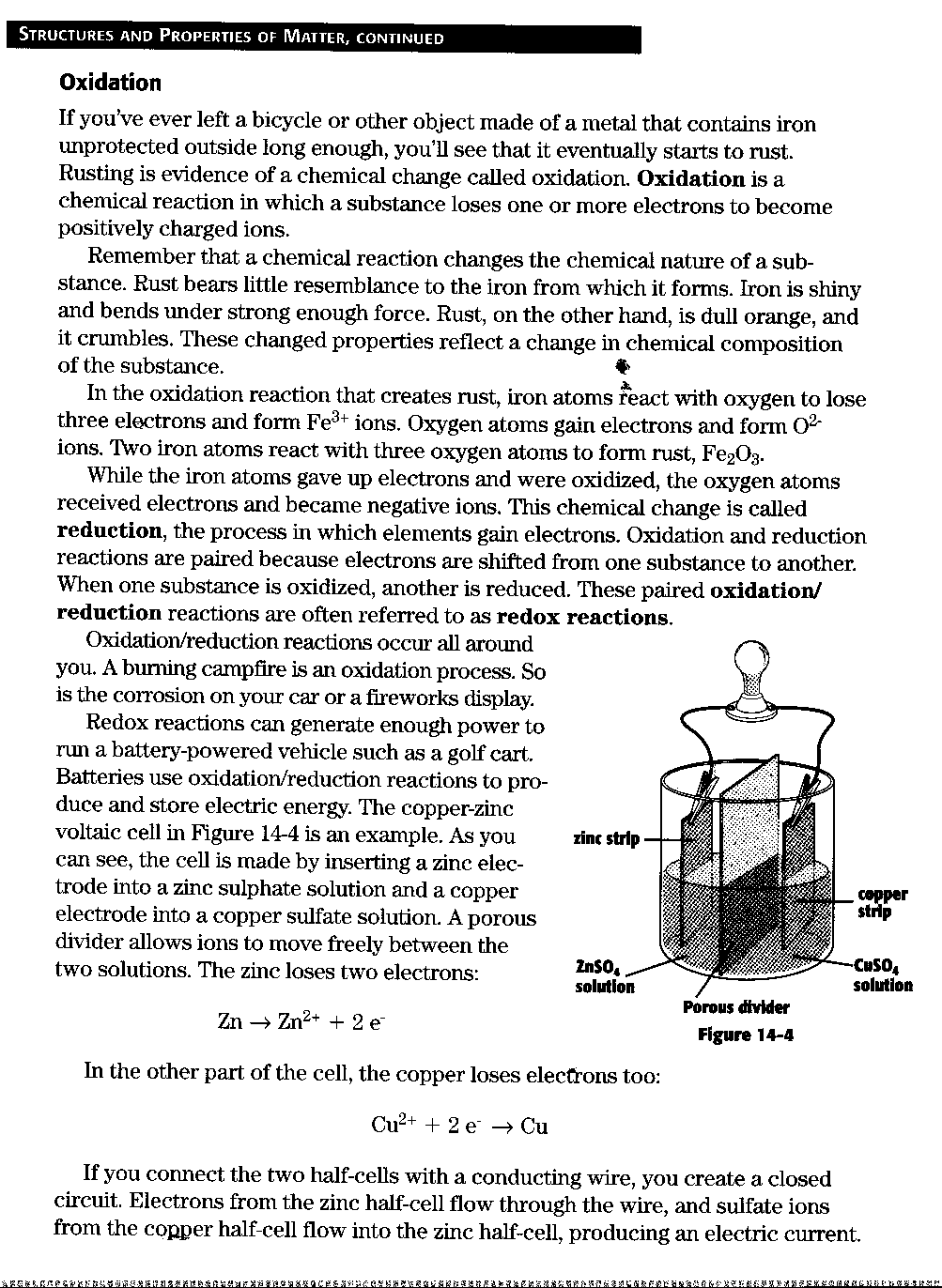
Study the two drawings and label them either physical or chemical change











**Oxidation**

*Read the preceding pages and answer the following questions in complete sentences*

1. What is oxidation?
2. What does a chemical reaction do?
3. How does an oxidation reaction create iron?
4. What is reduction?
5. Why are oxidation and reduction reactions paired?
6. How does a redox reaction generate energy to run a golf cart?

**Naming Compounds**

**IONIC COMPOUNDS versus MOLECULAR COMPOUNDS**

**Ionic compound**: consist of **cations** (positive ions) and **anions** (negative ions) held together by electrostatic attractions

--Usually **metal** + **nonmetal(s)**

--Made of monatomic ions, polyatomic ions, and/or both

--Monatomic ions; consist of a single atom

--Polyatomic ions; consist of more than one atom

**Molecular compound**: consist of nonmetals atoms bonded together by shared electrons (covalent bonding)

--acid: a molecular compound that releases hydrogen ion (H+) when dissolved in water

**NAMING MONATOMIC CATIONS:**

Metal atoms lose valence electrons to form positively charged ions, called **cations**. An ion formed from an individual atom is a **monatomic** (or monoatomic) **cation.**

1. Groups **IA, IIA, IIIA**, elements silver **(Ag)** and zinc **(Zn)** form only one type of ion;
   * Group IA elements form +1 ions: H+, Li+, Na+, K+
   * Group IIA elements form +2 ions; Be+2, Mg +2, Ca+2, Sr+2, Ba+2
   * Group IIIA elements form +3 ions; Al+3
   * Silver ion = Ag+; zinc ion = Zn+2

When a Group IA, IIA, IIIA element, silver, or zinc forms an ion, it is named:

**Element name + ion**

e.g. Na+ = sodium ion Sr+2 = strontium ion Zn+2 = zinc ion

1. The **Stock system** is used to name transition metals and other metals that form more than one ion:

--iron (Fe) forms two ions: Fe+2 and Fe+3

--lead (Pb) forms two ions: Pb+2 and Pb+4

When a metal can form more than one ion, each ion is named:

**Element name (charge in Roman numberals) + ion**

e.g. Fe+2 = iron (II) ion Pb+2 = lead (II) ion Cu+ = copper (I) ion

Fe+3 = iron (III) ion Pb+4 = lead (IV) ion Cu+2 = copper (II) ion

Name each of the following monatomic cations:

Li+ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ba+2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ag+ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Cu+2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Al+3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mg+2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mn+2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Sn+4 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

H+ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Co+3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fe+3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Na+ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

K+ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ti+4 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ca+2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ni+2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NAMING MONATOMIC ANIONS:**

**Nonmetal atoms gain valence electrons to form *negatively charged ions* called anions**.

When a nonmetal forms an ion, it is named:

**Element stem name + “ide” + ion**

e.g. O = oxygen atom → O-2 = oxide ion

N = nitrogen atom → N-3 = nitride ion

Name each of the following monatomic anions:

F- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Cl- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Br- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ S-2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ P-3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NAMING POLYATOMIC IONS:**

Ions made up of more than one atom are polyatomic ions:

--only one polyatomic cation: NH4+ = ammonium ion

\_\_many polyatomic anions: see table

NH4+ **Polyatomic Ions**

OH- = hydroxide ion NO2- = nitrite ion C2H3O2- = acetate ion

CN- = cyanide ion NO3- = nitrate ion PO4-3 = phosphate ion

CrO4-2= chromate ion SO4-2 sulfate ion MnO4-= permanganate ion

Cr2O7-2= dichromate ion SO3-2 = sulfate ion CO3-2 = carbonate ion

HCO3- = hydrogen carbonate ion or bicarbonate ion

Name each of the following polyatomic ions:

CN- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CrO4-2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

SO4-2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ NO3- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

OH- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PO4-3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

NH4+= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ C2H3O2- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**WRITING CHEMICAL FORMULAS GIVEN INDIVIDUAL IONS**

**Compounds must be neutral → total + ve charge = total –ve charge**

If the two ions have exactly opposite charges (+1 and -1, +2 and -2, +3 and -3)

→ **formula of the compound contains one of each ion**

e.g. Na+ + Cl- → NaCl K+ +NO3- → KNO3

Ca+2 + S-2 → CaS Ba+2 + SO4-2 → BaSO4

Al+3 + N-3 → AlN Fe+3 + PO4-3 → FePO4

Combine each pair of ions to get the formula of the compound they form:

NH4+ + F-→\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Li+ + CN- →\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sr+2 + CO3-2 →\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Al+3 + PO4-3→\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Na+ + C2H3O2- → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ K+ + OH- → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ni+2 + CrO4-2 → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Fe+3 + N-3 → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Cu+2 + SO4-2 → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Co+3 + P-3 → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If two monatomic ions have different charges

→ use crossover rule to get formula of the compound

* superscript for cation becomes subscript for anion
* superscript for anion becomes subscript for cation
* simplify subscripts to get lowest ratio of atoms (NOTE: Only the numbers cross down, NOT the signs!)

Na+ S2- Ba2+ N3- Ti4+ O2-

Na2S Ba3N2 Ti2O4

TiO2 (simplified)

If two ions have different charges and at least one polyatomic ion is involved:

→ use crossover rule to get formula of the compound

--if more than one of polyatomic ion in formula, use parentheses

--simplify subscripts to get lowest ration of atoms (**NOTE:** Again only the numbers cross down , **NOT** the signs!)

**NH4+ O2- Ca2+ NO3- PB4+ CO32-**

**(NH4)2O Ca(NO3)2 Pb2(CO3)4**

**Pb(CO3)2 simplified!**

Combine each pair of ions to get the formula of the compound they form:

Cu+ O-2 Sn+4 SO4-2 K+ P-3

Li+ CO3-2 Fe+3 S-2 Ni+2 PO4-3

**CHEMICAL FORMULAS AND NAMES FROM INDIVIDUAL IONS**

Compounds are named from the individual ions they come from.

Name the cation and the anion, then remove “ion from each name:

e.g. Na+ = sodium ion

Cl- = chloride ion → NaCl = sodium chloride

K+ = potassium ion

CO3-2 = carbonate ion → K2CO3 = potassium carbonate

Fe+3 = iron (III) ion

NO3- = nitrate ion → Fe(NO3)3 = iron (III) nitrate

Ag+ = silver ion

S-2 = sulfide ion → Ag2S = silver sulfide

Combine each pair of ions to get the chemical formula, then name the compound:

**Individual ions Compound Formula Compound Name**

Mg+2 F- \_\_\_\_\_\_\_\_MgF2\_\_\_\_\_\_\_\_ \_\_magnesium fluoride

Ni+2 S-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ca+2 Br- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Al+3 P-3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Co+2 NO2-  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

K+ CrO4-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ­­­­­­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fe+3 O-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

GIVEN THE CHEMICAL FORMULA, NAME THE COMPOUND

If the metal is in Groups IA – IIIA, silver, cadmium, or zinc, then just name the metal cation and the anion:

e.g. **NaCl** → Na = sodium and Cl = chloride → sodium chloride

**BaI2** → Ba = barium and I = iodide → barium iodide

**Al(OH)3** → Al = aluminum and OH = hydroxide → aluminum hydroxide

**ZnSO4** → Zn = zinc and SO4 = sulfate → zinc sulfate

If the metal can form more than one ion

1. Determine the charge on the cation using the charge on the anion.
2. Name the cation and the anion, then remove “ion” from both.

e.g. **NiBr2** → since the ion formed is Br-, then 2 Br’s have an overall negative charge of -2. to get an overall charge of zero for the compound, the overall positive charge must be +2. Thus, Ni must have a charge of +2, so the ion nickel forms is Ni+2.

**→ Ni+2 = nickel (II) ion Br- = bromide ion**

**→ NiBr2 = nickel (II) bromide**

1. If a polyatomic ion is involved, remember that more than one polyatomic is shown in parentheses—i.e. **DO NOT multiply the charge of the polyatomic ion with the subscript of the atoms in a polyatomic ion.**

**CuSO4** → There is only ONE Cu and ONE SO4, so get the charge for the Cu based on the SO4. The formula is SO4-2, and there is only ONE SO4-2, so Cu’s charge here must be +2 for the compound to have an overall charge of zero.

**→ Cu+2 = copper (II) ion SO4-2 = sulfate ion**

**Then → CuSO4 = copper (II) sulfate**

Give the name for each compound given its chemical formula:

|  |  |  |
| --- | --- | --- |
| **Formula** | **Individual Ions** | **Name of Compound** |
| MgCl2 | Mg+2 Cl- |  |
| LiOH |  |  |
| ZnCO3 |  |  |
| K2S |  |  |
| FePO4 |  |  |
| SnO2 |  |  |
| CuBr2 |  |  |
| Ag3N |  |  |
| Mn(CN)2 |  |  |
| AgC2H3O2 |  |  |

**WRITING CHEMICAL FORMULAS GIVEN THE COMPOUND NAME**

Get the individual ions from the name, then combine them using the crossover rule:

e.g. barium chloride → barium = Ba+2  chloride = Cl-

**Ba+2 Cl- → BaCl2**

Aluminum sulfate → aluminum = Al+3 sulfate = SO4-2

**Al+3 SO4-2 → Al2(SO4)3**

Give the chemical formula for each compound given its name:

|  |  |  |
| --- | --- | --- |
| **Name of Compound** | **Individual Ions** | **Formula** |
| Lithium cyanide | Li+ CN- | LiCN |
| Iron (III) sulfate |  |  |
| Calcium iodide |  |  |
| Tin (IV) dichromate |  |  |
| Silver nitrite |  |  |
| Copper (II) acetate |  |  |
| Zinc carbonate |  |  |
| Lead (II) phosphide |  |  |
| Potassium sulfite |  |  |
| Cobalt (II) nitride |  |  |
| Nickel (II) permanganate |  |  |

**NAMING MOLECULAR COMPOUNDS**

Indicate number of atoms of each element with Greek prefix before element name:

|  |  |  |  |
| --- | --- | --- | --- |
| **# of atoms** | **Greek Prefix** | **# of atoms** | **Greek Prefix** |
| 1 | mono (usually omitted) | 6 | hexa |
| 2 | di | 7 | hepta |
| 3 | tri | 8 | octa |
| 4 | tetra | 9 | nona |
| 5 | penta | 10 | deca |

For the first element: Greek prefix + element name

For the second element: Greek prefix + element name stem + “—ide”

**Note:** **Mono is generally omitted**, except in common names like

CO = carbon monoxide

**P2O5** **SF6**

diphosphorus pentaoxide sulfur hexafluoride

Name the following molecular compounds:

SO3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ SiBr4 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

XeF6 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ClF3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

N2O4 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Cl2O7 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

PCl5 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ P4O10 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**DETERMINING FORMULAS OF MOLECULAR COMPOUNDS**

Use Greek prefix(es) to determine number of atoms of each element in formula

Get elements and number of atoms of each from the name:

**tetra**phosphorus **hexa**sulfide

P4S6

Give the formula for each of the following molecular compounds

nitrogen trichloride dibromine heptaoxide dinitrogen pentasulfide

**DETERMINING FORMULAS AND NAMES OF ACIDS FROM IONS**

Given an ion,

We can get formula of acid by: adding H atoms equal to negative charge on ion

We can name for acid depending on suffix of ion name

Add # of H’s equal

To negative charge

F- = fluoride ion → → → HF (aq) = hydrofluoric acid

Add # of H’s equal

To negative charge

NO2- = nitrite ion → → → HNO2 (aq) = nitrous acid

Add # of H’s equal

To negative charge

SO4-2 = sulfate ion → → → H2SO4 (aq) = sulfuric acid

Name each of the following ions, and determine the formula and name of the corresponding acid that forms from the ion.

**Name of ion Formula of Acid Name of Acid**

CO3-2 = carbonate ion → H2CO3 \_\_\_\_\_ → carbonic acid\_\_\_\_\_\_\_\_\_

Cl- = \_\_\_\_\_\_\_\_\_\_\_\_\_\_→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

SO3-2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

PO4-3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

NO3- = \_\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name each of the following acids:

HBr (aq) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ H2CrO4 (aq) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

H2S (aq) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ HC2H3O2 (aq) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

HF (aq) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ H2SO4 (aq) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Give the formula for each of the following acids: [Don’t forget to indicate (aq)!]

phosphoric acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nitrous acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

hydroiodic acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ carbonic acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

sulfurous acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nitric acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**PUTTING IT ALL TOGETHER:**

Name each of the following compounds:

BaCl2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ NiBr2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

HNO3 (aq) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ SO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

AgF \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PbS2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CuSO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PF5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

K2SO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Cr(C2H3O2)3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

FeP \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Al2(CO3)3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

NiSO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ZN(OH)2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

KMnO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Sn(CN)2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**WRITING BINARY FORMULAS**

*Write the formulas for he compounds formed from the following ions.*

1. Na+, Cl- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Ba+2, F- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. K+, S-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Li+, Br- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Al+3, I- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Zn+2, S-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Ag+, O-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Mg+2, P-3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Ni+2, O-2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. Ni+3, O-2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. Fe+2, O-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. Fe+3, O-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. Cr+2, S-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. Cr+3, S-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
15. Cu+, Cl- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
16. Cu+2, Cl- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
17. Pb+2, O-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
18. Pb+4, O-2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
19. Mn+2, Br- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
20. Mn+4, Br- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NAMING BINARY COMPOUNDS (IONIC)**

1. BaCl2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. NaF \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Ag2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. CuB \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. CuBr2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. FeO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Fe2O3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. MgS \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Al2O3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. CaI2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. K2S \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. CrCl2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. CrCl3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. CaO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
15. Ba3P2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
16. Hg2I2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
17. Na2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
18. BeS \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
19. MnO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
20. Mn2O3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NAMING BINARY COMPOUNDS (COVALENT)**

*Name the following compound 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 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**FORMULAS WITH POLYATOMIC IONS**

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-** | **NO3-** | **CO3-2** | **SO4-2** | **PO4-3** |
| **H+** | **HOH**  **(H2O)** | **HNO3** | **H3CO3** | **H2SO4** | **H3PO4** |
| **Na+** |  |  |  |  |  |
| **Mg+2** |  |  |  |  |  |
| **NH4+** |  |  |  |  |  |
| **Ca+2** |  |  |  |  |  |
| **K+** |  |  |  |  |  |
| **Al+3** |  |  |  |  |  |
| **Pb+4** |  |  |  |  |  |

**NAMING COMPOUNDS (MIXED)**

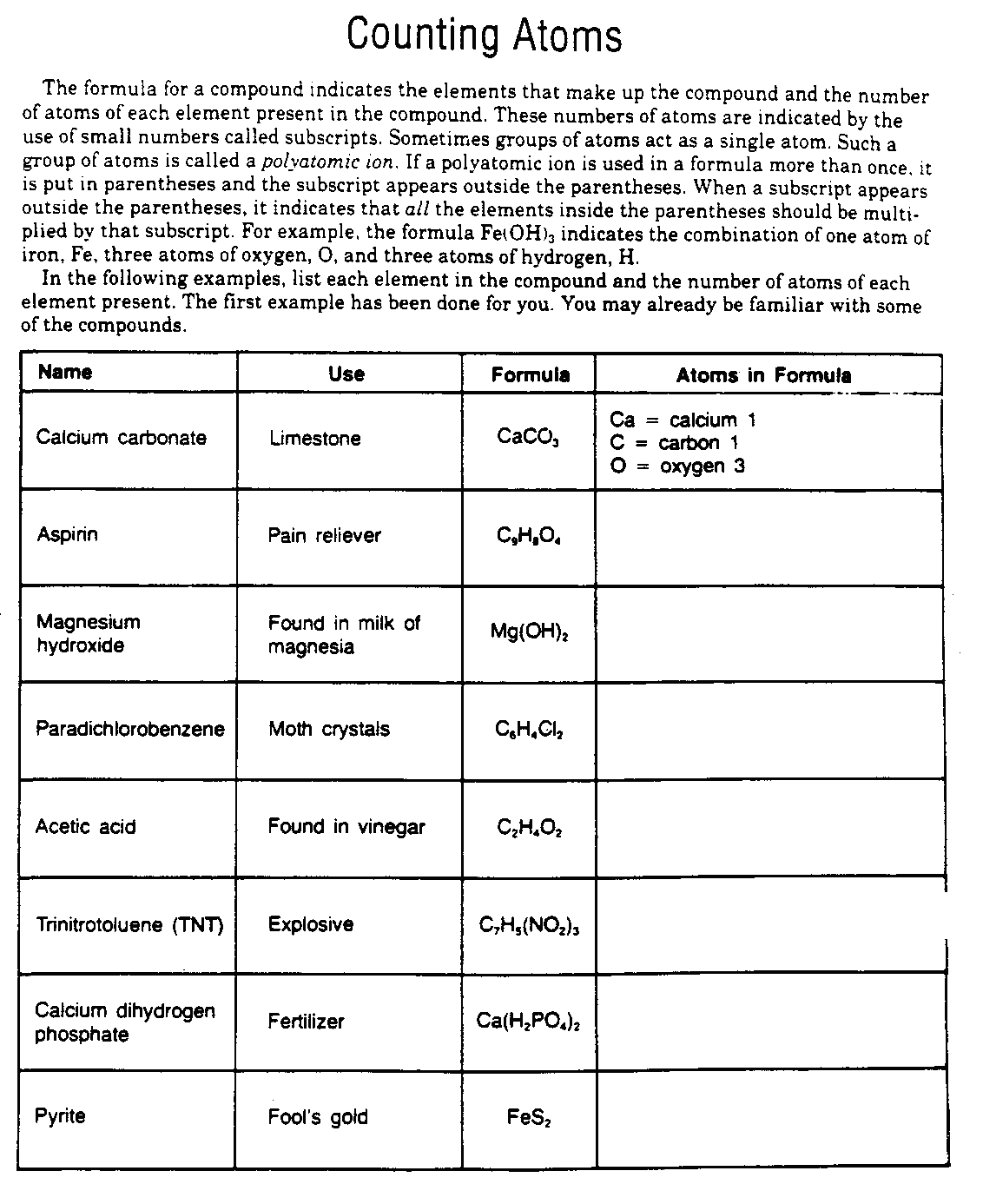
*Name the following compounds.*

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 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**WRITING FORMULAS FROM NAMES**

*Write the formulas for the following compounds*.

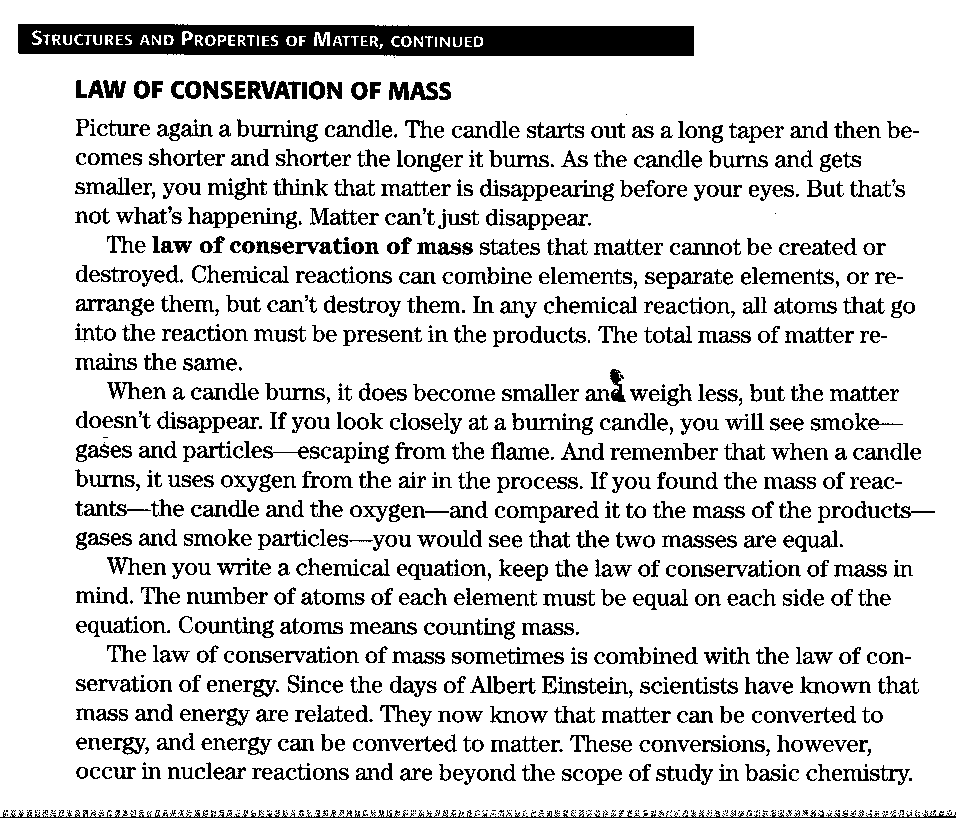
1. carbon monoxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. sodium chloride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. carbon tetrachloride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. magnesium bromide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. aluminum iodide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. hydrogen hydroxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. iron (II) fluoride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. carbon dioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. sodium carbonate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. ammonium sulfide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. iron (II) oxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. iron (III) oxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. magnesium sulfate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. sodium phosphate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
15. dinitrogen pentoxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
16. phosphorus trichloride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
17. aluminum sulfite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
18. copper (I) carbonate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
19. potassium hydrogen carbonate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
20. sulfur trioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Counting Atoms**

*Calculate how many atoms of each element are present in the following compounds.*

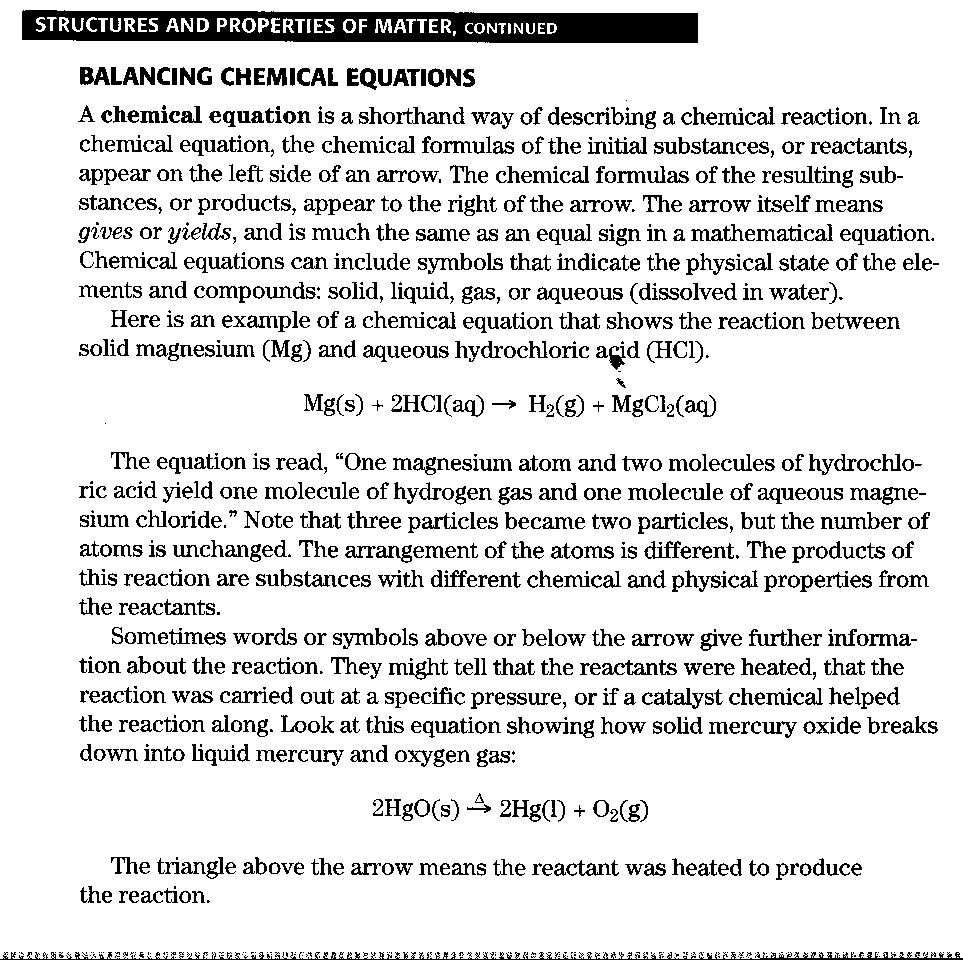
1. NaHCO3
2. C2H4O2
3. Mg(OH)2
4. 3H3PO4
5. 2H2SO4
6. (NH4)3PO4
7. C6H12O6
8. 4CaCO3

****

**Law of Conservation of Mass**

*Read the preceding page and answer the following questions in complete sentences.*

1. State the Law of Conservation of Mass.
2. How does the Law of Conservation of Mass apply to chemical reactions?
3. How does the Law of Conservation of Mass apply to writing chemical formula?
4. How are mass and energy related?



**Balancing Chemical Equations**

*Read the preceding page and answer the following questions in complete sentences.*

1. What is a chemical equation?
2. Name the parts of a chemical equation and explain each.
3. Compare the atoms in a reactant to the atoms in the product.
4. Why are there words or symbols above the arrow in some chemical equations?

**BALANCING EQUATIONS**

**Part A Chemical Equations**

Texas has one of the largest reserves of natural gas (methane) in the country. Natural gas is often used in homes as the primary source of heat, for cooking, and for providing hot water. When methane combines with oxygen during combustion, it produces carbon dioxide and water. The balanced chemical equation for the combustion reaction of methane is shown below.

CH4 + 2O2 → CO2 + 2H2O

Methane + oxygen → carbon dioxide + water

REACTANTS → PRODUCTS

The substances present before the reaction occurs are called the *reactants.* The reactants in this reaction are methane (CH4) and oxygen (O2). The *products* in a chemical equation are the substances produced by the reaction. The products in this reaction are carbon dioxide (CO2) and water (H2O).

In between the products and reactants, you see an arrow called the yield sign. The direction of the arrow shows the direction of the reaction and always points toward the products. The yield sign is similar to the equal sign in a mathematical equation. In a chemical equation, the reactants are always found to the left of the yield sign, while the products are always found to the right.

The numbers in front of the chemical formulas in the chemical equation are called *coefficients*. The coefficients indicate the number of atoms or molecules of a substance involved in the reaction. In this reaction, two molecules of oxygen were used as reactants and two molecules of water were formed as products. If no number appears in front of the formulas (as in CH4 and CO2), it means that only one molecule is present.

**Problems**

*Use the following balanced chemical equation to answer problems 1-4*

2H2 + O2 → 2H2O

Hydrogen + oxygen → water

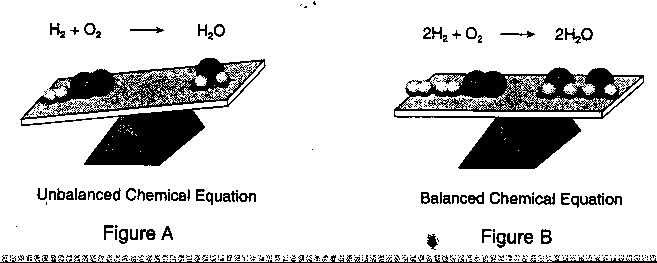
1. Name the product(s) in the reaction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Name the reactant(s) in the reaction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What is the coefficient of the product? What is the coefficient of oxygen? \_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What does the yield sign tell you about the reaction? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part B Balancing Chemical Equations**

In a balanced chemical equation, the number and kind of atoms that are present as reactants must be present as products. For example, Figure A represents the chemical reaction between hydrogen and oxygen to form water.



Notice that in the reactants there are 2 atoms of hydrogen and 2 atoms oxygen. In the products, however, there are 2 atoms of hydrogen, but only 1 atom of oxygen. This chemical equation is not balanced. To balance the equation, you add coefficients in front of the chemical formulas where they are needed. How can you make the number of oxygen atoms on the right equal the number on the left while keeping the hydrogen balanced? You can put a 2 in front of the formula for hydrogen and a 2 in front of the formulas for water. Figure B shows the balanced chemical equation for the reaction. Notice that the number of hydrogen and oxygen atoms in the reactants are the same as in the products.

**Problems**

1. Balance the following chemical equation
   1. \_\_\_\_\_ H2 + \_\_\_\_\_Cl2 → \_\_\_\_\_HCl
   2. What are the reactants? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. What are the products? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Balance the following chemical equation
   1. \_\_\_\_\_\_Br2 + \_\_\_\_\_\_KI → \_\_\_\_\_\_KBr +\_\_\_\_\_\_ I2
   2. What are the reactants? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. What is the coefficient of KI in the balanced equation? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**A Case of Balance – Reinforcement**

*Fill in the blanks to review how to balance equations.*

1. To balance an equation, you need to use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ , which are numbers placed in front of chemical symbols or formulas.
2. The first step to balancing an equation is counting the atoms. To do this, you multiply each element’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . Do this for each element on either side of the equation.
3. If an element has no subscript beside it, what number would you multiply its coefficient by? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. If an element has no coefficient in front of it, what number would you multiply its subscript by? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are on the left side of an equation, and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are on the right side.

Try balancing this equation: 4Fe + 3O2 → Fe2O3

1. First, count the atoms on the reactants side, so you need to multiply them by some number to equal the number of atoms on the reactants side.

Reactants → Products

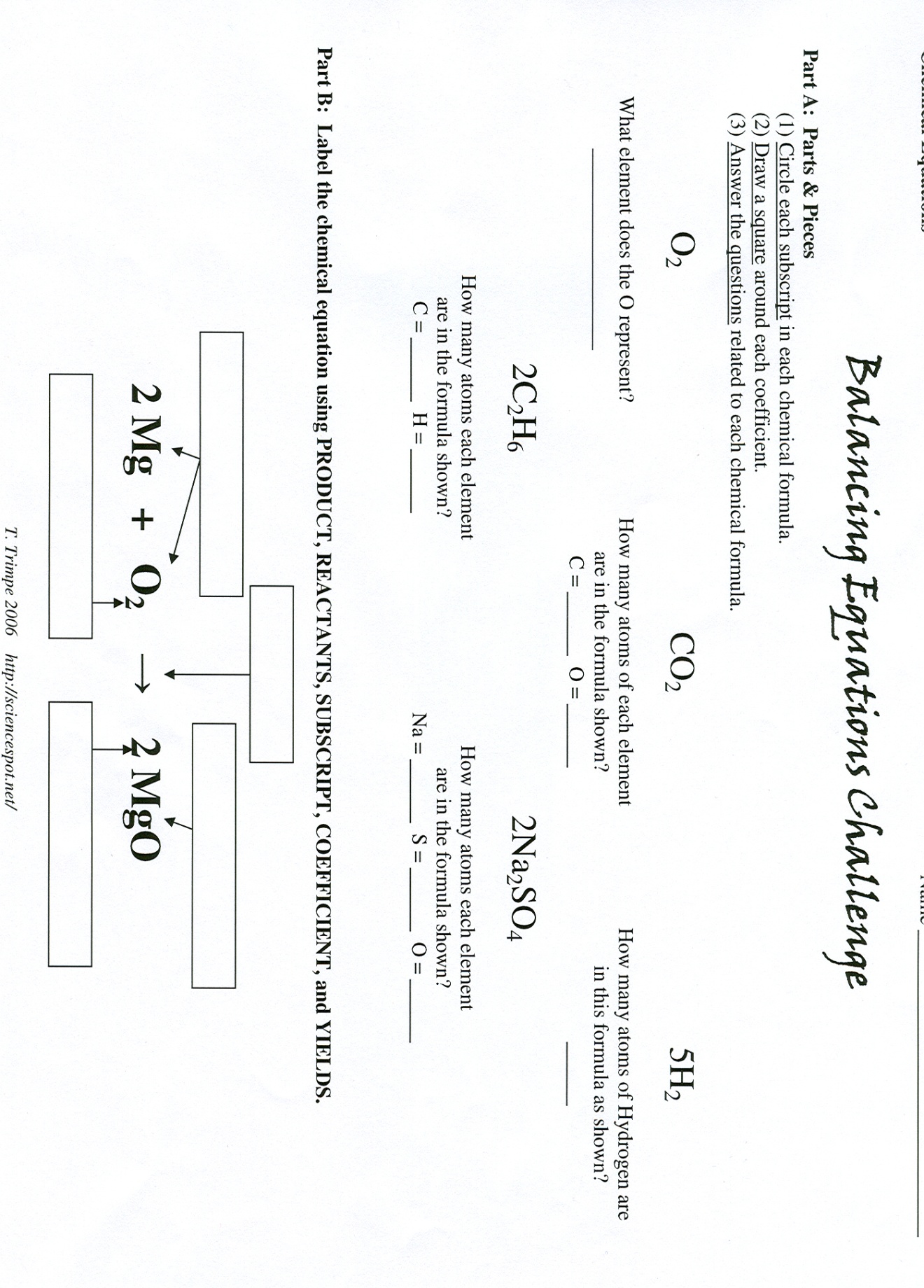
Fe = \_\_\_\_\_\_\_\_\_\_\_\_, O = \_\_\_\_\_\_\_\_\_\_\_, Fe = \_\_\_\_\_\_\_\_\_\_\_\_\_, O = \_\_\_\_\_\_\_\_

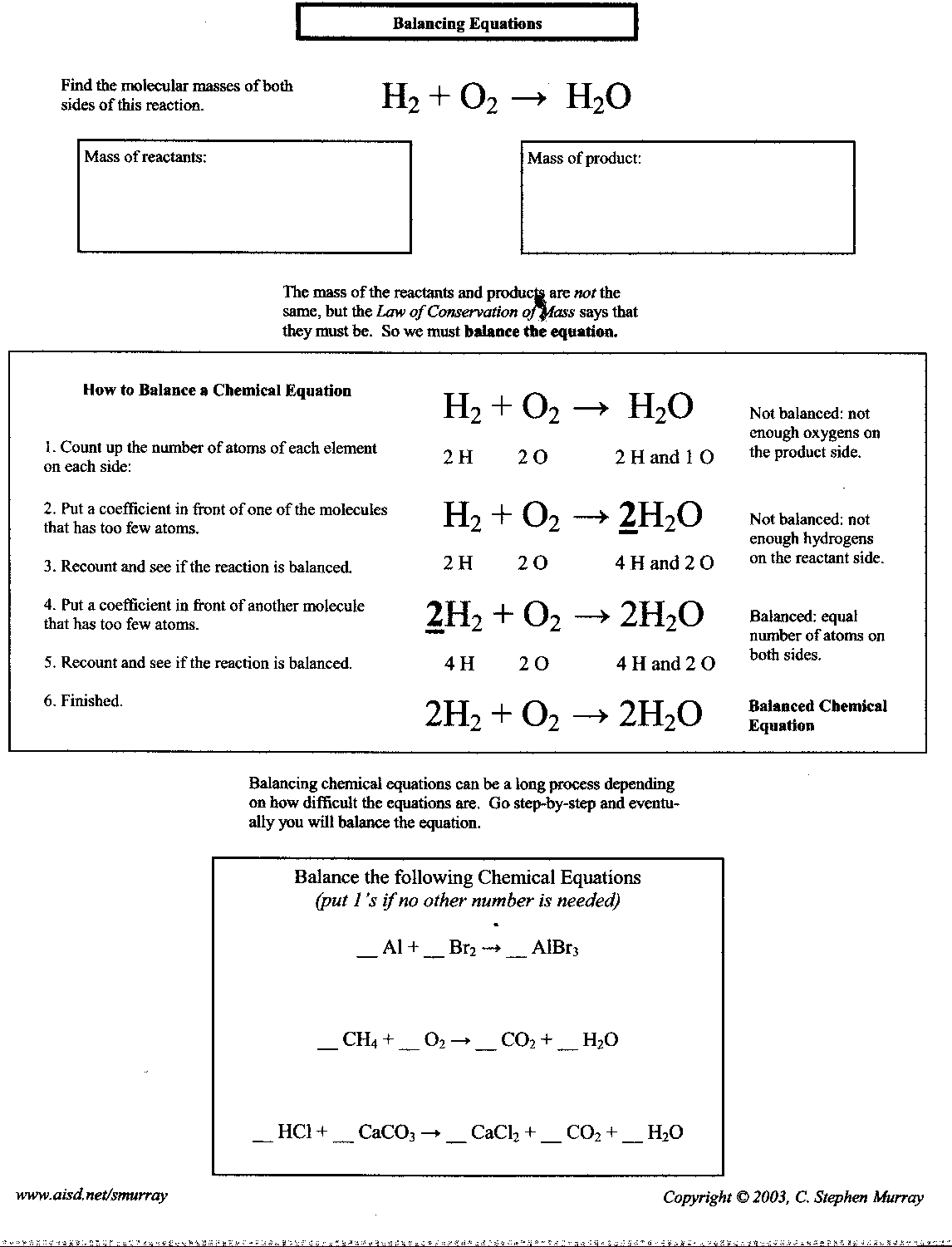
1. There are fewer atoms on the products side, so you need to multiply them by some number to equal the number of atoms on the reactants side.
2. Write the whole equation, using your last answer as a coefficient. \_\_\_\_\_\_\_\_\_\_\_\_\_
3. To check your work, recount the atoms using he new coefficient.

Reactants: Fe = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, O = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Products: Fe = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, O = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Are there the same number of atoms for each element on both sides of the equation? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Balancing Equations Practice**

**Part A: Identify the following parts of each chemical formula by circling the subscripts and drawing a square around the coefficients.**

H2 2HCl 4O2 CH4

3CO3 2NaOH

**Part B: List the symbols for the atoms in each formula and give the number of each.**

C2H6 2MgO 4P4O10

NH3 3Al(OH)3 2H2O2

**Part C: Count the atoms on each side of the equation.**

**P + O2** → **P4O10 Mg + O2** → **MgO**

P = P = Mg = Mg =

O = O = O = O =

**BaCl2 + H2SO4** → **BaSO4 + HCl**

Ba = Ba =

Cl = Cl =

H = H =

S = S =

O = O =

**Part D: Choose which coefficients balance the equations**

\_Cl2 + \_NaBr → \_NaCl + \_Br2 \_\_H2 + \_N2 → \_NH3

a. 2,2,2,1 a. 3,2,1

b. 3,2,1,1 b. 3,1,2

c. 1,2,2,1 c. 1,2,3

d. 1,1,2,3 d. 1,1,2

\_Na + \_Br2 → \_NaBr \_CuCl2 + \_H2S → \_CuS + \_HCl

a. 2,1,1 a. 2,1,2,1

b. 1,2,2 b. 1,1,1,2

c. 1,1,2 c. 2,2,1,1

d. 2,1,2 d. 1,2,1,2

\_HgO + \_Cl2 → \_\_HgCl + \_O2 \_\_C + \_H2 → \_CH4

a. 1,2,1,2 a. 1,2,1

b. 2,2,1,1 b. 2,1,2

c. 2,1,2,1 c. 1,1,2

d. 1,1,1,2 d. 2,2,1

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

**Balancing Equations**

**Multiple Choice.** Choose the correct numbers to balance out the equation. Once it is balanced count the atoms to check your answer.

1. \_\_\_\_\_Na + \_\_\_\_\_O2 → \_\_\_\_\_Na2O
   1. 2, 1, 2
   2. 4, 1, 2
   3. 2, 1, 1
2. \_\_\_\_\_H2 + \_\_\_\_\_O2 → \_\_\_\_\_H2O
   1. 1, 2, 1
   2. 2, 2, 2
   3. 2, 1, 2
3. \_\_\_\_\_Na2SO4 + \_\_\_\_\_CaCl2 → \_\_\_\_\_CaSO4 + \_\_\_\_\_NaCl
   1. 1, 1, 1, 2
   2. 2, 1, 1, 4
   3. 1, 2, 1, 2
4. \_\_\_\_\_Al2O3 → \_\_\_\_\_Al + \_\_\_\_\_O2
   1. 1, 2, 2
   2. 2, 3, 4
   3. 2, 4, 3
5. \_\_\_\_\_N2 + \_\_\_\_\_ H2 → \_\_\_\_\_NH3
   1. 1, 2, 3
   2. 2, 3, 1
   3. 1, 3, 2
6. \_\_\_\_\_Fe + \_\_\_\_\_H2O → \_\_\_\_\_Fe3O4 + \_\_\_\_\_H2
   1. 3, 4, 1, 4
   2. 3, 4, 2, 1
   3. 3, 3, 1, 4
7. \_\_\_\_\_P4 + \_\_\_\_\_O2 → \_\_\_\_\_P4O10
   1. 2, 3, 2
   2. 1, 5, 2
   3. 1, 5, 1
8. \_\_\_\_\_SiCl4 → \_\_\_\_\_Si + \_\_\_\_\_Cl2
   1. 1, 1, 4
   2. 1, 1, 2
   3. 1, 2, 2

**Balancing equations**

1. 2.

\_HgO + \_Cl2 → \_\_HgCl + \_O2 \_\_C + \_H2 → \_CH4

a. 1,2,1,2 a. 1,2,1

b. 2,2,1,1 b. 2,1,2

c. 2,1,2,1 c. 1,1,2

d. 1,1,1,2 d. 2,2,1

1. 4.

\_Na + \_Br2 → \_NaBr \_CuCl2 + \_H2S → \_CuS + \_HCl

a. 2,1,1 a. 2,1,2,1

b. 1,2,2 b. 1,1,1,2

c. 1,1,2 c. 2,2,1,1

d. 2,1,2 d. 1,2,1,2

5. 6.

\_Cl2 + \_NaBr → \_NaCl + \_Br2 \_\_H2 + \_N2 → \_NH3

a. 2,2,2,1 a. 3,2,1

b. 3,2,1,1 b. 3,1,2

c. 1,2,2,1 c. 1,2,3

d. 1,1,2,3 d. 1,1,2

7.

\_\_Na2SO4 + \_\_CaCl2 → \_\_CaSO4 + \_\_NaCl

1. 1, 1, 1, 2
2. 2, 1, 1, 4
3. 1, 2, 1, 2
4. 2, 2, 1, 3

**Balancing Equations**

*Balance the following chemical equations*

1. CH4 + O2 → CO2 + H20
2. Na + I → NaI
3. N2 + O2 → N20
4. N2 + H2 → NH3
5. KI + Cl2 → KCl + I2
6. HCl + Ca(OH)2 → CaCl2 + H2O
7. KClO3 → KCl + O2
8. K3PO4 + HCl → KCl + H3PO4
9. S + O2 → SO3
10. KI + Pb(NO3)2 → KNO3 + PbI2
11. CaSO4 + AlBr3 → CaBr2 + Al2(SO4)3
12. H2O2 → H2O + O2
13. Na + H2O → NaOH + H2
14. C2H6 + O2 → CO2 + H2O
15. Mg(NO3)2 + K3PO4 → Mg3(PO4)2 + KNO3

