

G9 chemistry worksheet (EOT3)

• Word Puzzle: -

Directions: In this word search puzzle, find and circle the four terms listed below. Then write each term on the line before its definition.

conduct

ion

ionic bond

metallic bond

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| U | U | K | N | O | M | V | M | H | R | R |
| T | C | Z | E | Y | E | X | O | T | O | C |
| Z | V | C | H | G | T | P | C | N | C | I |
| E | R | F | L | N | A | R | A | I | O | G |
| U | Q | J | T | P | L | Y | O | M | N | I |
| Z | K | Z | N | A | L | N | K | Z | T | C |
| K | R | U | P | F | I | Z | U | F | V | O |
| F | J | C | H | C | C | X | U | U | S | N |
| H | E | C | B | A | B | X | F | T | E | D |
| F | A | O | R | G | O | Z | V | Y | O | U |
| S | N | P | I | J | N | E | T | H | K | C |
| D | Y | S | C | Q | D | I | S | S | J | T |

conduct

1. to serve as a medium through which something can flow

ionic bond

2. a chemical bond between positively and negatively charged ions

metallic bond

3. a chemical bond between metal atoms

ion

4. an atom that has lost or gained valence electrons.

• Complete: -

1. Metal atoms form compounds with other metals by combining, or pooling, their valence electrons.

2. A(n) metallic bond is a bond formed when many metal atoms share their pooled valence electrons.

a. When metal atoms lose their valence electrons, they become positive ions.

b. Valence electrons in metals are not bonded to any particular atom; instead, all metal ions are surrounded by a sea of free moving electrons.

3. Metals are **good** conductors of electricity because their valence electrons can easily move from ion to ion, transferring electric charge.
4. Metals can **easily** be hammered into a sheet or drawn into a wire because the ions slide past one another through the electron pool.
5. Metals are shiny because the **valence electrons** at their surface interact with light.

Understanding Chemical Reactions

A. Changes in Matter

1. A(n) **physical** change does not produce new substances.
2. During a(n) **chemical** change, new substances form.
 - a. The starting substances and the substances **produced** have different physical and chemical **properties**.
 - b. A chemical reaction is a process in which **atoms** of one or more substances rearrange to form one or more new **substances**.

B. Signs of a Chemical Reaction

1. Sometimes, changes in **physical** properties, such as color or odor, indicate a chemical reaction.
 - a. Formation of bubbles of a(n) **gas** can also be a sign of chemical reaction.
 - b. A solid formed when two liquids are mixed is called a(n) **precipitate** and can be evidence of a chemical reaction.
2. A change in **energy** is another sign that a chemical reaction has occurred.
 - a. **thermal** energy is absorbed or released during a chemical reaction and is evidenced by warming or cooling.
 - b. **light** energy might also be released during a chemical reaction.
3. The only way to be certain a chemical reaction has taken place is to compare the **chemical composition** of the substances before and after the change.

C. What happens in a chemical reaction?

1. During a chemical reaction, **Atoms** of elements or compounds **rearrange** and form new elements or compounds.
2. Atoms rearrange when chemical **bonds** between atoms break.

D. Chemical Equations

1. A(n) **chemical equation** is a description of a reaction using element **symbols** and chemical formulas.

E. Conservation of Mass

1. The law of **conservation of mass** states that the total mass of the reactants before a chemical reaction is the same as the total mass of the products after the chemical reaction.
2. Mass is conserved in a chemical reaction because **atoms** are conserved.
3. To show that mass is conserved, a chemical equation must show that the number of each type of **atoms** must be **balanced**, or the same on both sides of the equation.
 - a. Chemical equations are balanced by adding **coefficients**.
 - b. A coefficient is a(n) **number** placed in front of an element symbol or a chemical formula in an equation.

• Short answer: -

1. What is metallic bonding?

It is electrical attraction between positive ions and a sea of free moving electrons.

2. Why are metals shiny?

Because their valence electrons interact with light.

3. **When metals and nonmetals bond, they do not share electrons. Instead, one or more valence electrons transfers from the metal to the nonmetal atom.**

- a. What is an ion?

It is an atom or a group of atoms carrying an electrical charge by losing or gaining electrons.

4. **Sodium is a metal. Chlorine is a nonmetal. The two atoms create the stable compound NaCl.**

a. Why is NaCl a stable compound?

Because each ion achieved the octet rule and become stable , they have the electron configuration of the nearest noble gases.

5. **Positive and negative ions have opposite charges and attract each other, just as magnets do.**

a. What is an ionic bond?

It is the electrical attraction between positive and negative ions.

6. **The third type of chemical bond occurs between metals.**

a. How do metal atoms create a bond?

Metal atoms lose their valence electrons which move freely, then those atoms become positive ions.

Positive ions will be surrounded by mobile electrons and attraction happens.

7. **Describe** how metallic bonds contribute to the physical characteristics of a metal.

The free moving electrons make metals good conductors, Also metals will be malleable and ductile because of the cloud of the free moving electrons.

• Fill in the blanks: -

Directions: On each line, write the term from the word bank that correctly completes each sentence. Each term is used only once.

| | | | | | |
|-----------|----------|---------|------------|----------|----------|
| atoms | elements | ionic | ions | metals | negative |
| nonmetals | positive | sharing | table salt | transfer | |

1. The bonding of **metals** and **nonmetals** does not involve the **sharing** of electrons.

2. Instead, this type of bonding is characterized by the **transfer** of electrons.

3. When elements join in this way, their atoms become ions.
4. The loss of one or more electrons results in a(n) positive charge; the gain of one or more electrons results in a(n) negative charge.
5. One common ionic compound is NaCl, also known as table salt.

• True or false: -

Directions: On the line before each statement, write T if the statement is true or F if the statement is false.

- F** 1. An ionic bond forms when a nonmetal atom transfers one or more valence electrons to a metal atom.
- F** 2. Covalent bonds are stronger than ionic bonds.
- T** 3. The shiny appearance of metals is caused by valence electrons on the surface.
- F** 4. An atom with seven valence electrons would most likely lose an electron to become stable.

(Chemical reactions)

Key Concept What happens to atoms during a chemical reaction?

Directions: On the line before each statement, write T if the statement is true or F if the statement is false. If the statement is false, change the underlined words(s) to make it true. Write your changes on the lines provided.

- T** 1. A chemical change has the same meaning as a chemical reaction.

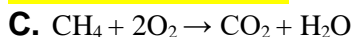
- F** 2. In a physical change, atoms of one or more substances rearrange to form one or more new substances chemical change.
- F** 3. An element is a substance made up of different kinds of atoms bonded together (a compound).
- T** 4. Substances have a fixed arrangement of atoms _____.
- T** 5. Chemical bonds must break and new bonds must form for atoms to rearrange. _____
- F** 6. The bonds between atoms can break when compounds collide with enough energy. (Particles)
- F** 7. Hydrogen and oxygen combining to form water is an example of a physical change. (chemical change)

- F** 8. A physical bond is an attraction between atoms so electrons are shared.
(**chemical bond**)
- I** 9. During a chemical reaction, bonds between atoms break and new bonds form.

- I** 10. Water is an example of a substance. _____
- F** 11. The thickening of syrup when it is put into the refrigerator is an example of a chemical change. (**Physical change**)
- I** 12. Adding electric energy to water molecules can cause the bonds between hydrogen and oxygen to break. _____
- F** 13. Atoms disappear during a chemical change. (**Conserved**)

• **Choose the correct answer: -**

- _____ 1. Which type of atom forms a flexible bond with other atoms of the same element by sharing a large pool of valence electrons?
A. metal
B. metalloid
C. nonmetal
- _____ 2. A metallic bond forms when valence electrons move freely around a metal atom that has become a
A. noble gas.
B. positive ion.
C. covalent compound.
- _____ 3. Which type of bond joins nonmetal atoms to nonmetal atoms?
A. ionic
B. metallic
C. covalent
- _____ 4. Which situation involves a chemical change?
A. food rotting
B. paper ripping
C. water freezing
- _____ 5. Which statement proves that a chemical reaction has occurred?
A. Bubbles form in a liquid.
B. At least one substance changes color.
C. Substances with new chemical properties are formed.
- _____ 6. Which equation is balanced?
A. $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$



_____ 7. Which situation does **NOT** occur during chemical reactions?

A. Bonds are broken.

B. Atoms are created.

C. Compounds are formed.

• Match: -

Directions: On the line before each definition, write the letter of the term that matches it correctly. Not all terms are used.

A. metallic bond

B. electron dot diagram

C. ionic bond

D. valence electron

E. polar molecule

F. ion

G. chemical bond

C 4. a bond between positively and negatively charged ions

G 5. a force that holds atoms together

A 6. a chemical bond formed when positively charged atoms share their electrons

F 7. an atom that is no longer electrically neutral

E 8. has a slight positive end and a slight negative end because of unequal sharing of electrons

D 9. the part of an atom that participates in chemical bonding

• Complete: -

Directions: Complete the chart with the correct term from the word bank in the space provided. Each term is used only once

atom

balanced equation

chemical bonds

chemical reaction

compound

conservation of mass

element

produces

product

reactant

| | |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $C + O_2 \longrightarrow CO_2$ | <p>1. Which three terms could be used to identify the carbon (C) in this chemical equation?</p> <p>Atom, element, reactant</p> |
| $2H_2 + O_2 \longrightarrow 2H_2O$ | <p>2. This is an example of a balanced chemical equation. What law is used to describe a balanced equation?</p> <p>Conservation of mass</p> |
| $2Na + Cl_2 \longrightarrow 2NaCl$ | <p>3. What does the arrow in the equation mean?</p> <p>produces</p> <p>4. What chemical equation term is used for the chemical formula to the right of the arrow?</p> <p>product</p> <p>5. What type of substance is NaCl?</p> <p>compound</p> |
| $H_2O + SO_3 \longrightarrow H_2SO_4$ | <p>6. holds together the atoms in a compound?</p> <p>Chemical bonds</p> <p>7. How does this chemical equation show a conservation of mass?</p> <p>It is a(n) balanced equation.</p> <p>8. What does the rearrangement of atoms indicate has taken place? Chemical reaction</p> |

• Balancing equations: -

Directions: Put a check mark on the line to show if the equation is balanced or unbalanced. If the equation is unbalanced, circle each element that is not balanced.

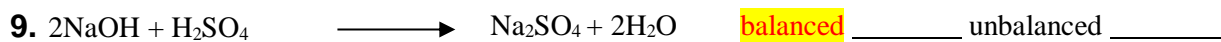
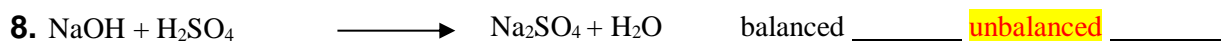
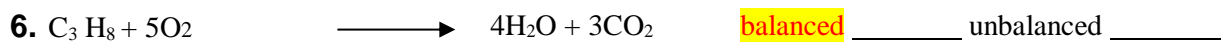
1. $H_2 + O_2 \longrightarrow H_2O$ balanced _____ **unbalanced** _____

2. $2H_2 + O_2 \longrightarrow 2H_2O$ **balanced** _____ unbalanced _____

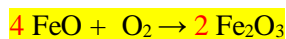
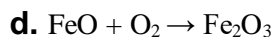
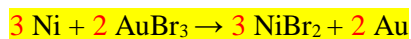
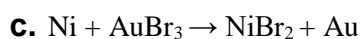
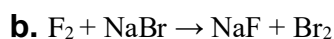
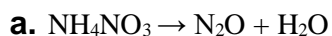
3. $CH_4 + O_2 \longrightarrow CO_2 + H_2O$ balanced _____ **unbalanced** _____

4. $CH_4 + O_2 \longrightarrow CO_2 + 2H_2O$ balanced _____ **unbalanced** _____

5. $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$ **balanced** _____ unbalanced _____

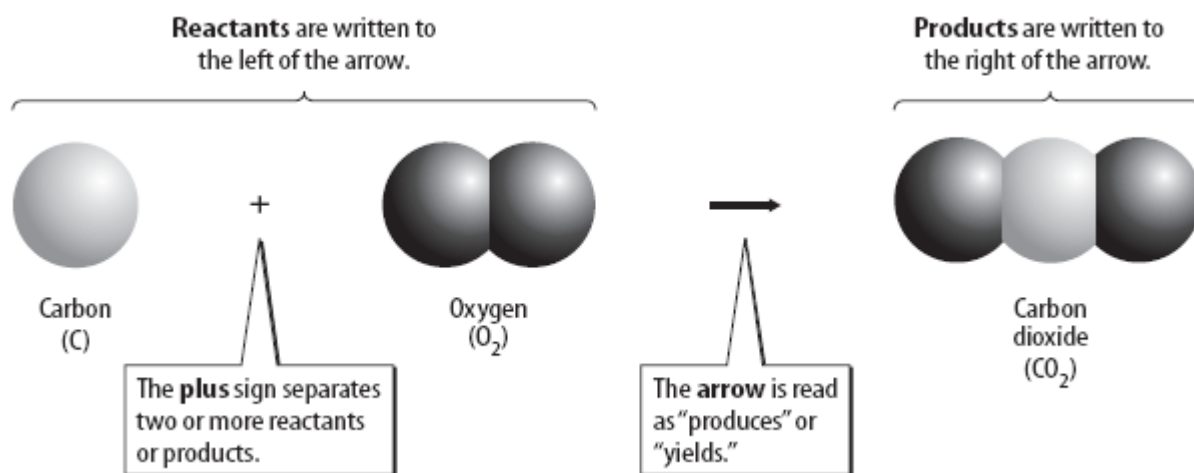


10. Chemical reactions are described with balanced equations to show that mass is conserved during the reaction. A balanced equation demonstrates that the same number of atoms of each element is present before and after the reaction. Balance the following equations:



Key Concept What happens to the total mass in a chemical reaction?

Directions: Use the diagram to answer each question on the lines provided.



1. How does the chemical equation show that a chemical reaction has occurred?

It shows the new arrangement of atoms.

2. What two elements bond in the chemical equation shown in the diagram?

Carbon and Oxygen

3. What does the subscript indicate in the chemical formula CO₂?

There are two atoms of oxygen in this molecule.

4. What happens to the total mass of the carbon and oxygen after they form carbon dioxide?

It is conserved.

5. What is true of the total mass of reactants compared to the total mass of products?

They are equal.

6. Why is mass conserved in a chemical reaction?

Because the number of atoms in both reactants and products is the same.

7. What is true about the atoms at the start of a chemical reaction compared to the atoms at the end of the reaction?

They are the same but in different arrangements.

Directions: On the line before each definition, write the letter of the term that matches it correctly. Some terms may be used more than once or not at all.

- A. chemical reaction
- B. physical change
- C. substance
- D. chemical bonds
- E. chemical equation
- F. element
- G. chemical formulas
- H. compound
- I. symbol
- J. reactants
- K. product
- L. conservation of mass

- B** 1. cannot be changed into another substance
- C** 2. Carbon dioxide is an example.
- B** 3. Substances stay the same before and after change.
- K** 4. substance produced by a chemical reaction
- L** 5. law shown by a balanced equation
- H** 6. fixed arrangement of atoms
- I** 7. H is used for hydrogen.
- G** 8. represent compounds
- J** 9. starting substances in a chemical reaction
- F** 10. Na is used for sodium in the periodic table.
- L** 11. The total mass of reactants equals the total mass of products.
- E** 12. description of a reaction using chemical symbols
- A** 13. process where atoms rearrange to form a new substance
- B** 14. Water becomes ice.
- E** 15. uses chemical symbols and formulas

• **Problem solving: -**

- 1. Calculate the molar mass for the following: -
 - a. Sodium hydroxide

NaOH, Molar mass= $(1 \times 23) + (1 \times 16) + (1 \times 1) = 40 \text{ g/mol}$

b. Sodium carbonate

$$\text{Na}_2\text{CO}_3, \quad \text{molar mass} = (2 \times 23) + (1 \times 12) + (3 \times 16) = 46 + 12 + 48 = 106 \text{ g/mol}$$

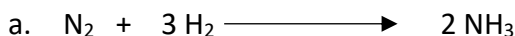
c. Dinitrogen tetra oxide

$$\text{N}_2\text{O}_4, \quad \text{molar mass} = (2 \times 14) + (4 \times 16) = 28 + 64 = 92 \text{ g/mol}$$

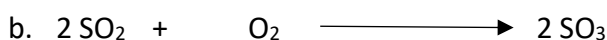
d. Methane

$$\text{CH}_4, \quad \text{molar mass} = (1 \times 12) + (4 \times 1) = 16 \text{ g/mol}$$

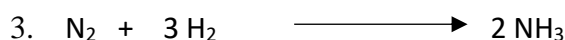
2. Find all mole ratios of the following equations: -



$$\frac{1 \text{ mol N}_2}{3 \text{ mol H}_2}, \frac{1 \text{ mol N}_2}{2 \text{ mol NH}_3}, \frac{3 \text{ mol H}_2}{1 \text{ mol N}_2}, \frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3}, \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2}, \frac{2 \text{ mol NH}_3}{3 \text{ mol H}_2}$$



$$\frac{2 \text{ mol SO}_2}{3 \text{ mol H}_2}, \frac{2 \text{ mol SO}_2}{1 \text{ mol O}_2}, \frac{2 \text{ mol SO}_2}{2 \text{ mol SO}_3}, \frac{1 \text{ mol O}_2}{2 \text{ mol SO}_2}, \frac{1 \text{ mol O}_2}{2 \text{ mol SO}_3}, \frac{2 \text{ mol SO}_3}{2 \text{ mol SO}_2}, \frac{2 \text{ mol SO}_3}{1 \text{ mol O}_2}$$



a. How many moles of hydrogen required to react completely with 7 moles of Nitrogen?

$$7 \text{ moles of N}_2 \times \frac{3 \text{ mol H}_2}{1 \text{ mol N}_2} = 21 \text{ moles of H}_2$$

b. how many grams of Ammonia are produced when 3 moles of nitrogen are used?

$$3 \text{ moles of N}_2 \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \times \frac{17 \text{ g NH}_3}{1 \text{ mol NH}_3} = 102 \text{ g NH}_3$$

4. What is the mass of 2.5 moles of NaOH?

$$2.5 \text{ moles of NaOH} \times \frac{40 \text{ g NaOH}}{1 \text{ mol NaOH}} = 100 \text{ g NaOH}$$

5. How many moles a 30 g of NaHCO₃ contains?

$$30 \text{ g NaHCO}_3 \times \frac{1 \text{ mol NaHCO}_3}{84 \text{ g NaHCO}_3} = 0.36 \text{ mol NaHCO}_3$$