AIM 14 | What is a synthesis reaction?

Chemical reactions are happening around you all the time. A match burns. A car rusts. Food spoils. Leaves decay. These are just a few chemical reactions.

Probably the most important chemical reactions take place in your body. They are happening this very moment. *Digestion* is a chemical process. So is *respiration*. In every one of your *trillions* of cells, chemical reactions are taking place all the time. Life *depends* upon chemical reactions.

There are several kinds of chemical reactions. One kind is the *synthesis* [SIN thuh sis] reaction. "Synthesis" means *a putting together*. A synthesis reaction *combines* substances, *usually* elements, to form a compound. When the compound forms, we say it has been *synthesized*. Below is a "model" of a synthesis reaction.

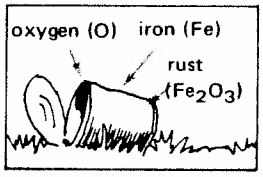
$$A + B \longrightarrow AB$$

Element + Element $\longrightarrow$ Compound

Let's study two synthesis reactions.

1. RUSTING When iron rusts, it *combines* with oxygen.

Remember this equation?

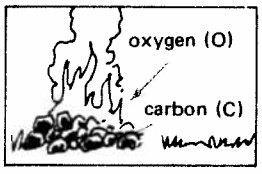


$$4Fe + 3O_2 \longrightarrow 2Fe_2O_3$$

Iron + Oxygen $\longrightarrow$ Iron oxide (rust)

Element + Element $\xrightarrow[\text{to form}]{\text{link up}}$ Compound

2. THE BURNING OF CARBON Charcoal is made of the element carbon (C). When carbon burns, it *combines* with oxygen. This produces the gas carbon dioxide (CO_2).



$$C + O_2 \longrightarrow CO_2$$

Carbon + Oxygen $\xrightarrow[\text{to form}]{\text{link up}}$ Carbon dioxide

Element + Element $\longrightarrow$ Compound

A synthesis reaction is like *any* other kind of chemical reaction. No matter is created. No matter is destroyed. The atoms just change their arrangement.

UNDERSTANDING SYNTHESIS REACTIONS

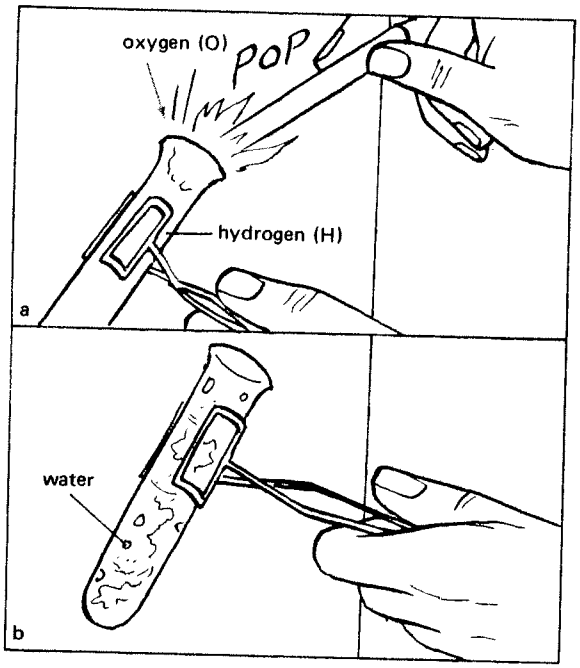


Figure A

Look at Figures A, B, and C, and read the explanation. Then answer the questions with each.

When hydrogen explodes, it combines with oxygen.

Water is produced.

The equation shows what happens:

$$H_2 + O_2 \longrightarrow H_2O$$

Hydrogen + Oxygen ⟶ Water

1. Hydrogen is _____ .
   an element, a compound

2. Oxygen is _____ .
   an element, a compound

3. Water is _____ .
   an element, a compound

4. Is the formation of water a synthesis reaction? _____

5. Why is the formation of water a synthesis reaction? _____

_____

6. A compound has at least one metal and one nonmetal. In the synthesis of water, which is the metal, hydrogen or oxygen? (Hint: Look at the formula for water.)

_____

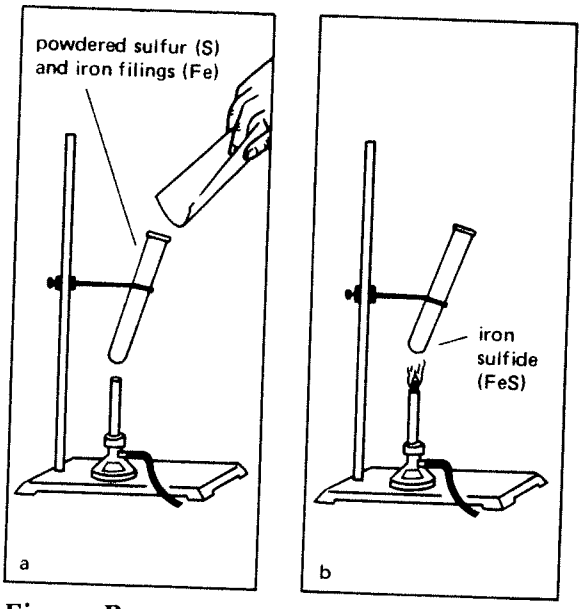


Figure B

When powdered sulfur and iron filings are heated together, they form *iron sulfide.*

This equation shows what happens:

$$Fe + S \longrightarrow FeS$$

Iron + Sulfur ⟶ Iron sulfide

7. Iron is _____ .
   an element, a compound

8. Sulfur is _____ .
   an element, a compound

9. Iron sulfide is _____ .
   an element, a compound

10. What happens to the iron and sulfur when they form iron sulfide? _____

_____

11. Why is the formation of iron sulfide a synthesis reaction? _____

_____

12. In the synthesis of iron sulfide, which element is the metal? _____

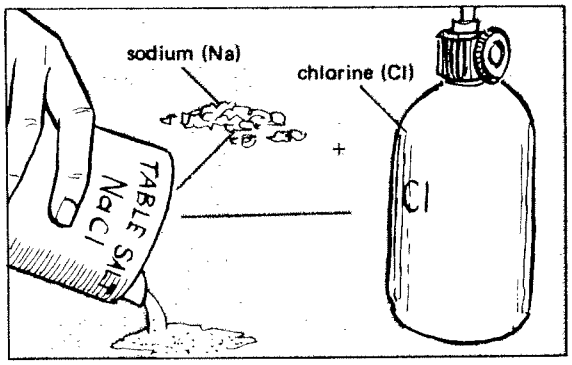


Figure C

Sodium combines with chlorine to form sodium chloride—common table salt.

This equation shows what happens:

$$Na + Cl \longrightarrow NaCl$$

Sodium + Chlorine ⟶ Sodium chloride

13. Sodium is _____ (an element, a compound).

14. Chlorine is _____ (an element, a compound).

15. Sodium chloride is _____ (an element, a compound).

16. **a)** What kind of reaction is the formation of sodium chloride? _____

b) Why? _____

17. In the synthesis of sodium chloride, which element is the *nonmetal*? _____

YOUR OWN WORDS, PLEASE

1. What does "synthesis" mean? _____

_____

2. What does "synthesis reaction" mean? _____

_____

Two synthesis equations are shown on the next page. They are different from the ones you have read about in this Aim.

Equation I $CO_2 + C \longrightarrow 2CO_2$

Equation II $CO_2 + H_2O \longrightarrow H_2CO_3$

3. How is Equation I different from the other synthesis equations in this Aim?

_____

4. How is Equation II different from the other synthesis equations in this Aim?

_____

IDENTIFYING SYNTHESIS REACTIONS

Ten equations are listed below. Some are synthesis reactions. Some are not. Make a check (√) in the correct box next to each equation.

Equation	A Synthesis Reaction	Not a Synthesis Reaction
1. $2K + Br_2 \longrightarrow 2KBr$		
2. $2H_2O \longrightarrow 2H_2 + O_2$		
3. $NaCl \longrightarrow Na + Cl$		
4. $4Au + 3O_2 \longrightarrow 2Au_2O_3$		
5. $2Na + 2HCl \longrightarrow 2NaCl + H_2$		
6. $Cu + Br_2 \longrightarrow CuBr_2$		
7. $Zn + S \longrightarrow ZnS$		
8. $2Na + Br_2 \longrightarrow 2NaBr$		
9. $2HgO \longrightarrow 2Hg + O_2$		
10. $2Na + I_2 \longrightarrow 2NaI$		

TRUE OR FALSE

Write T on the line next to the number if the sentence is true.
Write F if the sentence is false.

1. _____ There is only one kind of chemical reaction.
2. _____ A synthesis reaction separates a compound into its elements.
3. _____ The *reactants* of *every* synthesis reaction are elements.
4. _____ The *product* of a synthesis reaction is a compound.
5. _____ Chemical reactions take place only in the laboratory.

REACHING OUT

Most compounds made of only two elements have names ending in *-ide*. For example:

NaCl = sodium *chloride*
K_2S = potassium *sulfide*

Can you name these compounds?

	Formula	Name
1.	CaO	
2.	KI	
3.	NaBr	
4.	AgF	
5.	MgCl	

WORD SEARCH

The words in this list are hidden within the groups of letters. Try to find each word. When you find it, draw a line around the word. The spelling may go in any direction.

MATTER
POLYVALENT
RADICAL
WEIGHT
REACTANT
FORMULA
PHYSICAL
PRODUCT
YIELDS
CHEMICAL

C	T	L	A	C	I	S	Y	H	P	A
H	O	N	L	A	C	I	M	E	H	C
I	Y	I	E	L	D	S	C	N	O	D
M	I	C	A	L	U	M	R	O	F	M
T	N	A	T	C	A	E	R	T	T	Y
N	E	L	E	H	W	V	H	G	C	L
R	I	A	L	D	E	A	Y	L	U	L
A	L	R	A	D	I	C	A	L	D	I
I	S	Y	R	A	G	L	E	Y	O	M
J	E	R	R	Y	H	D	W	I	R	P
C	L	R	E	T	T	A	M	E	P	I