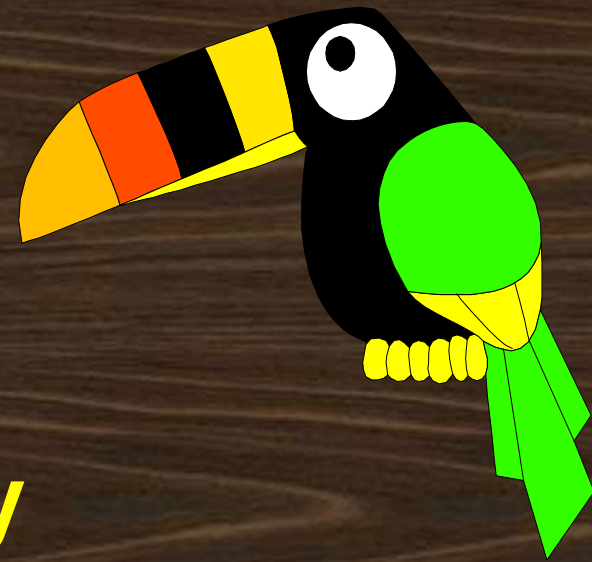


Chemical Reactions and Quantities

Chemical Changes
Balancing Chemical Equations

Physical Properties

- **color**
- **melting point**
- **boiling point**
- **electrical conductivity**
- **specific heat**
- **density**
- **state (solid, liquid, or gas)**



Physical Change

Changes in physical properties

- melting
- boiling
- condensation



No change occurs in the identity of the substance

Example:

Ice , rain, and steam are all water

Chemical Change

- Atoms in the reactants are rearranged to form one or more different substances
- Old bonds are broken; new bonds form

Examples:

Fe and O₂ form rust (Fe₂O₃)

Ag and S form tarnish (Ag₂S)

Learning Check E1

Classify each of the following as a

1) physical change or 2) chemical change

A. _____ a burning candle

B. _____ melting ice

C. _____ toasting a marshmallow

D. _____ cutting a pizza

E. _____ polishing silver

Solution E1

Classify each of the following as a

1) physical change or 2) chemical change

A. 2 a burning candle

B. 1 melting ice

C. 2 toasting a marshmallow

D. 1 cutting a pizza

E. 2 polishing silver

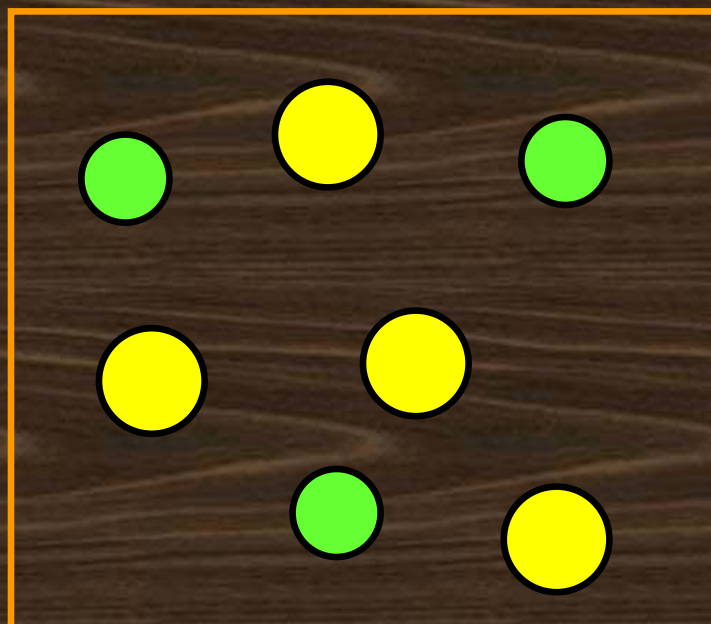
Chemical Reaction

A process in which at least one new substance is produced as a result of chemical change.

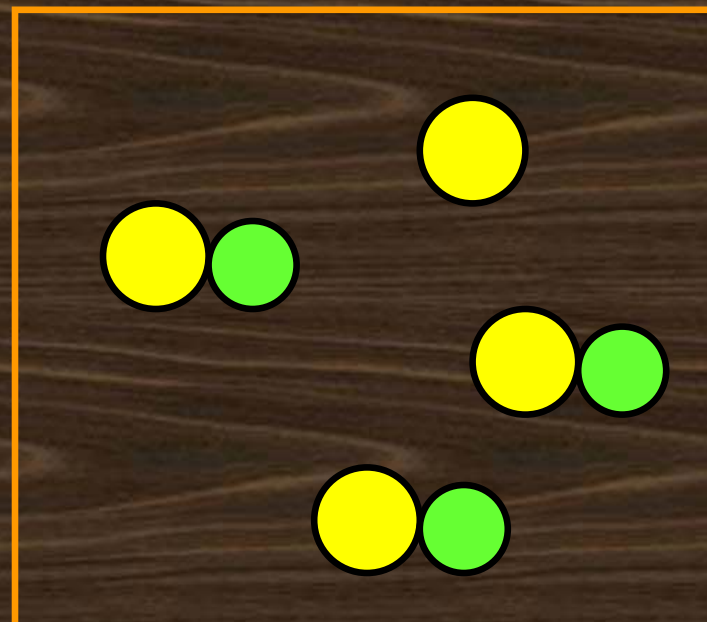


A Chemical Reaction

Reactants



Products



Learning Check E2

- A. How does an equation indicate a change in the identity of the reacting substances?**

- B. How did the yellow and green reactants combine?**

- C. Did all the reactants form product? Why or why not?**

Learning Check E2

A. How does an equation indicate a change in the identity of the reacting substances?

The formulas of the reactants are different than the formulas of the products.

B. How did the yellow and green reactants combine? 1 yellow combined with 1 green.

C. Did all the reactants form product? Why or why not? No. There were more yellow reactants than green.

Writing a Chemical Equation

Chemical symbols give a “before-and-after” picture of a chemical reaction

Reactants

Products



magnesium oxide
reacts with carbon

to form

carbon monoxide
and magnesium

Learning Check E3

12 oz of dough, 4 oz mushrooms, 12 slices pepperoni, 8 oz cheese and 5 oz tomato sauce are used to make a pizza. Write a recipe in words for putting together a pizza.



How would you write the recipe as an equation?

Solution E3

Example: Combine 12 oz dough + 4 oz mushrooms + 12 slices pepperoni + 8 oz cheese + 5 oz tomato sauce and heat 30 minutes at 350°C to produce 1 pizza

12 oz dough + 4 oz mshrm
+ 12 pep + 8 oz chse \longrightarrow 1 pizza
+ 5 oz tom sauce

Reading A Chemical Equation



Four molecules of NH_3 react with five molecules O_2 to produce four molecules NO and six molecules of H_2O

or

Four moles NH_3 react with 5 moles O_2 to produce four moles NO and six moles H_2O

A Balanced Chemical Equation

Same numbers of each type of atom on each side of the equation



Matter Is Conserved



Total atoms

=

Total atoms

2 H, 2 Cl

2H, 2 Cl

Total Mass

=

Total Mass

2(1.0) + 2(35.5)

2(36.5)

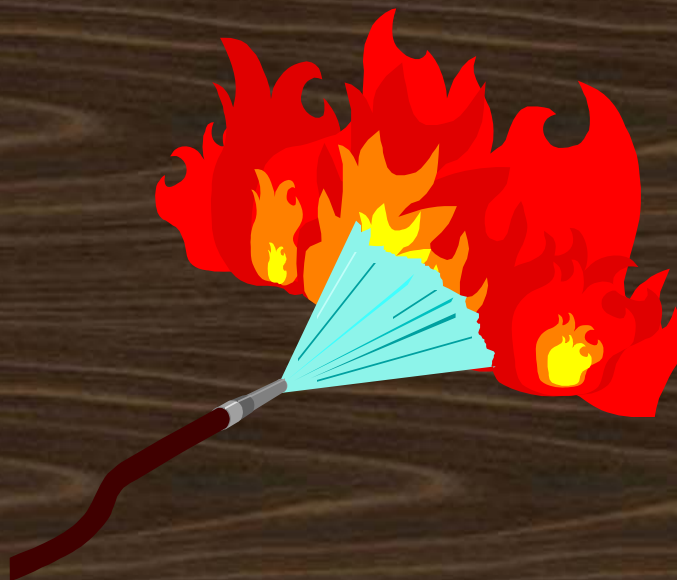
73.0 g

=

73.0 g

Law of Conservation of Mass

In any ordinary chemical reaction, matter is not created nor destroyed



Balance Equations with Coefficients

Coefficients *in front* of formulas balance each type of atom



$$4 \text{ N} = 4 \text{ N}$$

$$12 \text{ H} = 12 \text{ H}$$

$$10 \text{ O} = 10 \text{ O}$$

Steps in Balancing An Equation



Learning Check E4



A. Number of H atoms in 4 H₂O

1) 2

2) 4

3) 8

B. Number of O atoms in 4 H₂O

1) 2

2) 4

3) 8

C. Number of Fe atoms in Fe₃O₄

1) 1

2) 3

3) 4

Solution E4



A. Number of H atoms in 4 H₂O

3) 8

B. Number of O atoms in 4 H₂O

2) 4

C. Number of Fe atoms in Fe₃O₄

2) 3

Learning Check E5

Balance each equation. The coefficients for each equation are read from left to right



1) 1, 3, 2

2) 3, 1, 2

3) 3, 1, 1

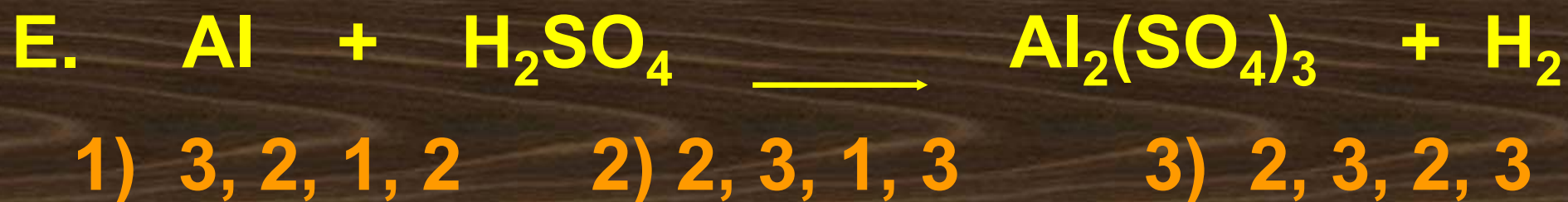
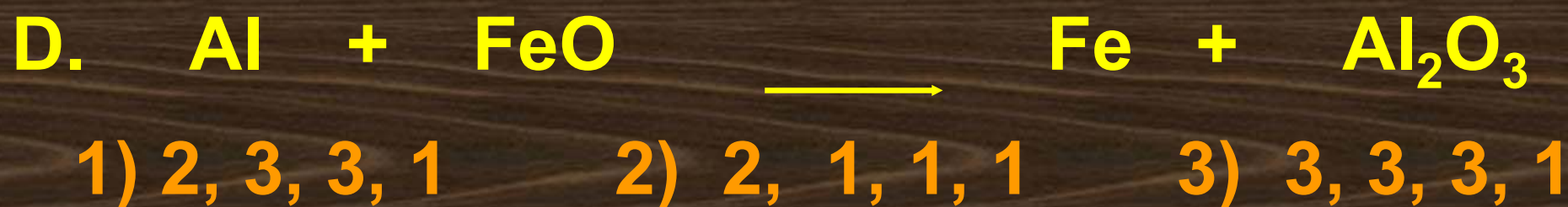
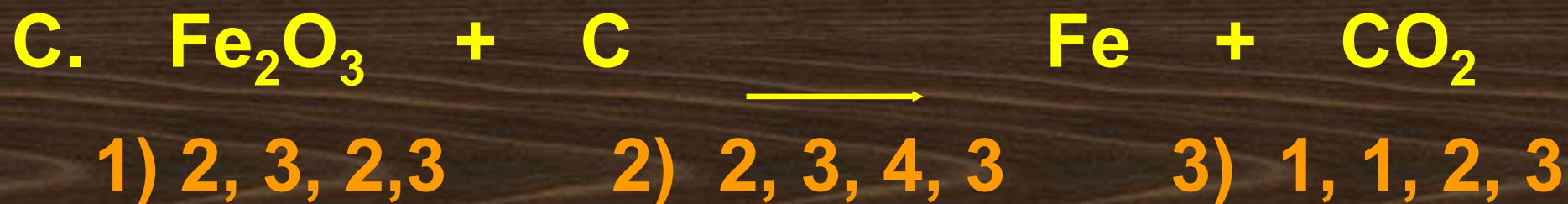


1) 3, 3, 2

2) 1, 3, 1

3) 2, 3, 2

Learning Check E5



Solution E5

