N4 – Properties, Changes, and Types of Matter

Target: I can classify matter and types of changes to matter.

Properties of Matter

Extensive properties

Depend on the **AMOUNT** of matter that is present.

- **Volume**
- **Mass**
- **Energy Content (think Calories)**

Intensive properties

Depend only on the **TYPE** of matter present, *not the amount* present

- **Melting point**
- **Boiling point**
- **Density**

Which of the following is an EXTENSIVE property?

AMOUNT

It is a solid at 25 °C.

It has a density of 1.38 g/cm^3.

It melts at 62.0 °C.

It has a volume of 0.52 cm^3.

It is shiny.

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Physical and Chemical Properties

- **PHYSICAL PROPERTY**
  a property that a substance displays without changing its composition.
  - *Odor, taste, color, appearance, melting point, boiling point, and density*

- **CHEMICAL PROPERTY**
  a property that a substance displays only by changing its composition via a chemical change/rxn
  - *Corrosiveness, acidity, and toxicity.*

All of the following are examples of physical properties EXCEPT:

Density

Hardness

Melting Point

Combustible

Luster

All of the following are examples of physical properties EXCEPT:

A. Density

B. Hardness

C. Melting Point

D. ***Combustible***

E. Luster

Which of the following is a chemical property?

You can squeeze oranges to make orange juice

Butter can be melted for popcorn

Sand can be separated from gravel

Hydrogen peroxide decompose into water and oxygen

Ozone is a gas at room temperature

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Types of Changes

Physical Change

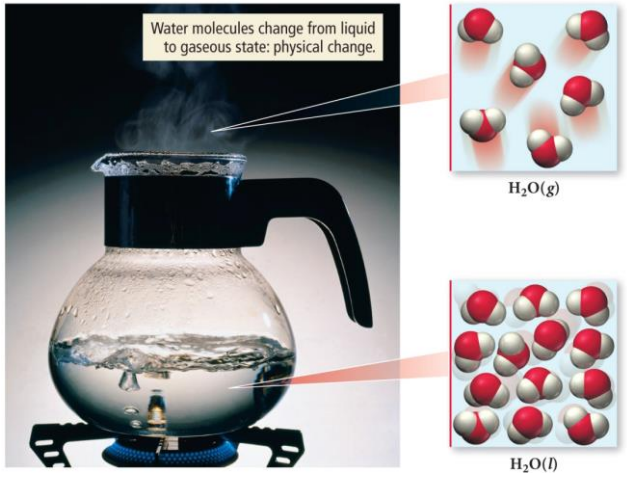
Chemical Change

Physical Change

- Changes only the **state or appearance**, but **not composition**

- The atoms or molecules **do not change their identity** during a physical change.

- **EXAMPLE:** Boiling water

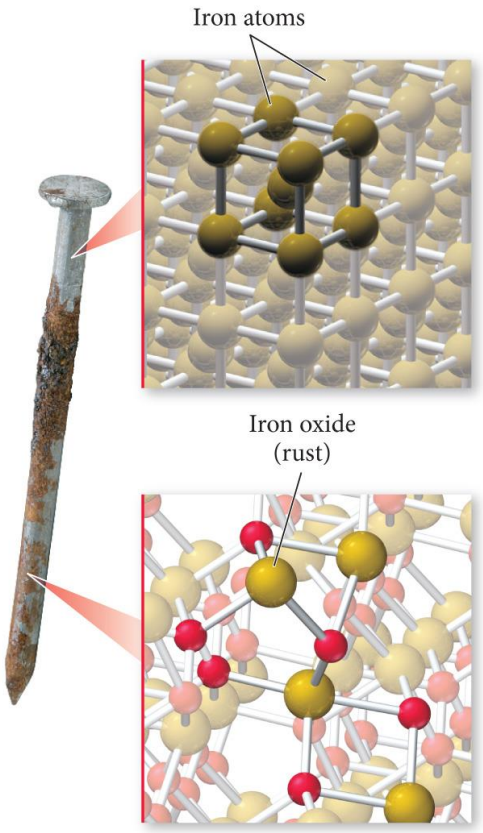


Chemical Change

- Changes the **composition/ identity** of the substance

- Atoms rearrange, transforming the original substances into **different substances**.

- **EXAMPLE:** Iron rusting. Started as Fe and then it bonds with oxygen to make FeO.



The Classification of Matter

- **Matter** is anything that occupies space and has mass.

- We can classify matter according to:
  - **state** (solid, liquid, gas)
  - **composition** (the basic components its made of).

Classification of Matter by Components

- The first division in the classification of matter is between a *pure substance* and a *mixture*.

- **Pure substance** is made up of only one component and its composition is invariant.

- **Mixture**, by contrast, is a substance composed of two or more components in proportions that can vary from one sample to another.

Classification of Pure Substances

- **Element:** a substance that cannot be chemically broken down into simpler substances.
  - Basic building blocks of matter
  - Composed of single type of atom, like helium

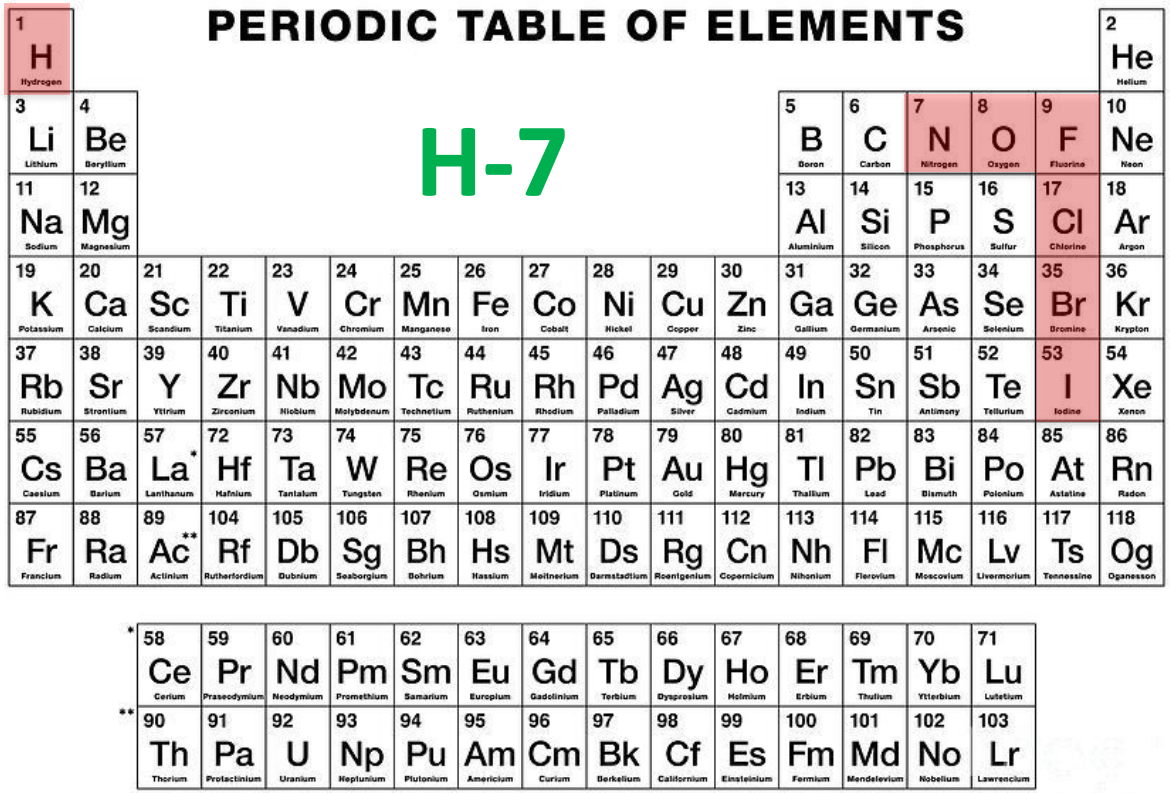
- **Molecule** is a substance composed of two or more atoms, but can be the same element – H_2, Br_2, H_2O, CO_2

- **Compound** is a substance composed of two or more types of elements. H_2O, CO_2

Classification of Pure Substances

- **Careful!**
  - **"Diatomic Elements" are actually molecules!**

H_2	*Horses*
N_2	*Need*
O_2	*Oats*
F_2	*For*
Cl_2	*Clear*
Br_2	*Brown*
I_2	*"Eyes"*



Classification of Mixtures

- **Heterogeneous:** composition varies from one region of the mixture to another.
  - Chicken noodle soup, oil and vinegar

- **Homogeneous mixtures:** uniform compositions because the atoms or molecules that compose them mix uniformly.
  - Salt water, air

Which of the following is a heterogeneous mixture?

Kool-aid

Coffee

A latte

Hydrogen peroxide

Ice

Which of the following is a heterogeneous mixture?

A. Kool-aid

B. Coffee

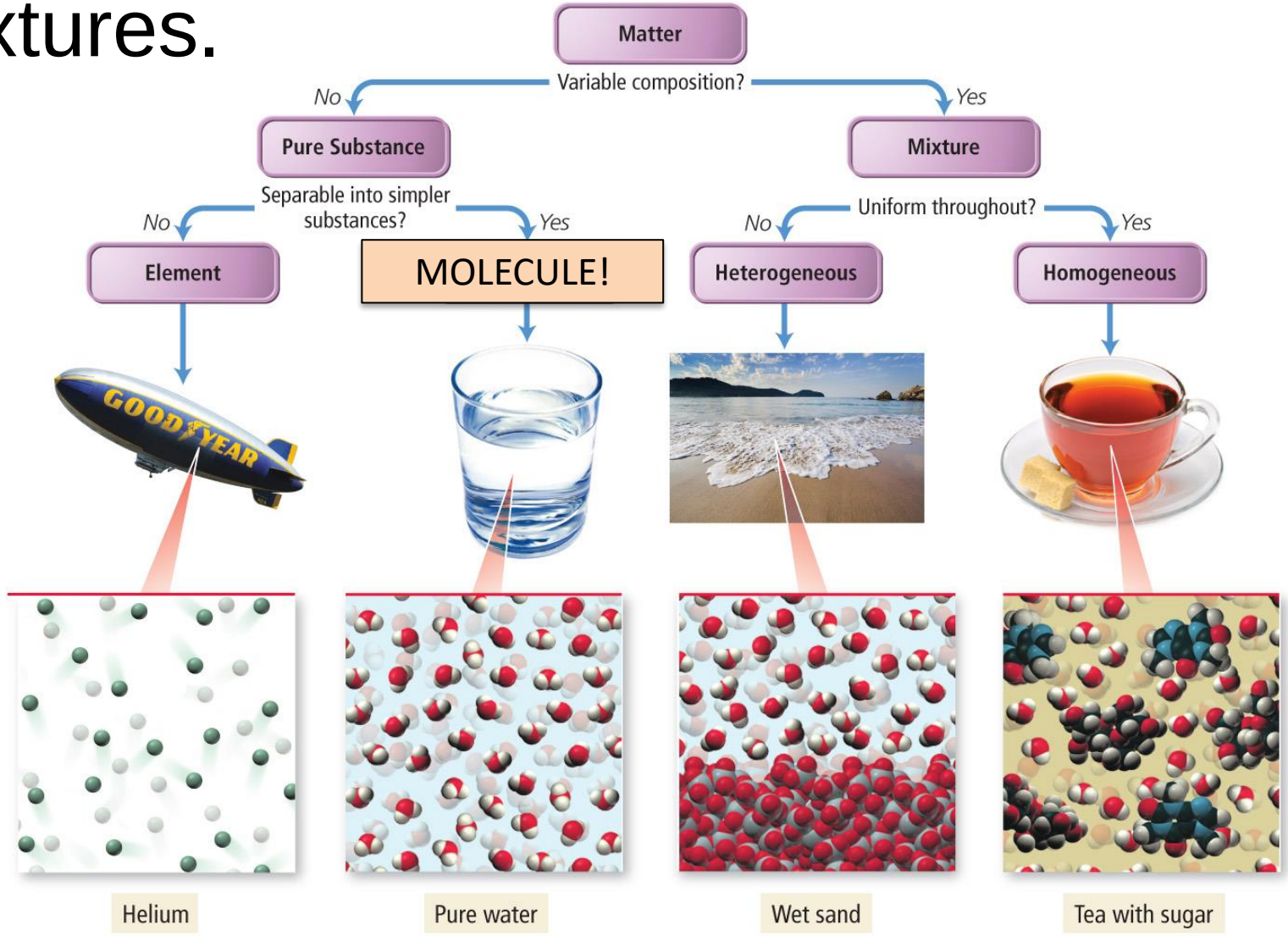
C. ***A latte***

D. Hydrogen peroxide

E. Ice

The Classification of Matter by Components

- Elements, compounds, and types of mixtures.



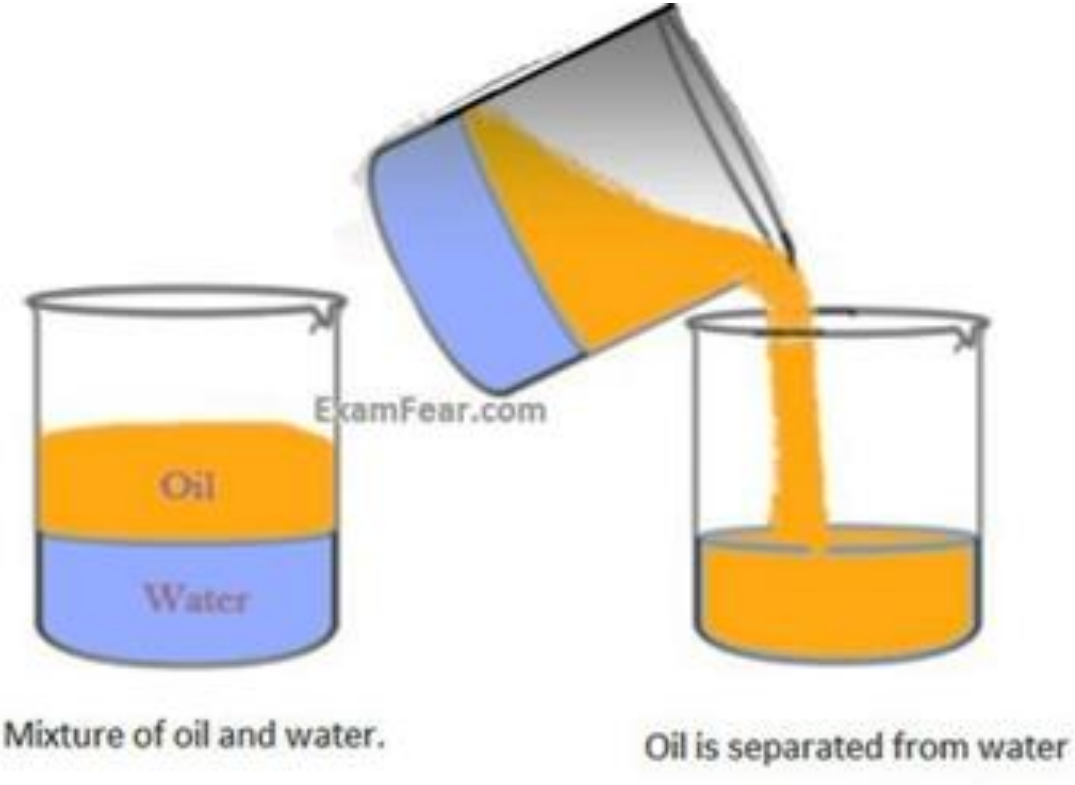
Separating Mixtures

- Are separable because the different components have different physical or chemical properties.

- Various techniques that exploit these differences are used to achieve separation.

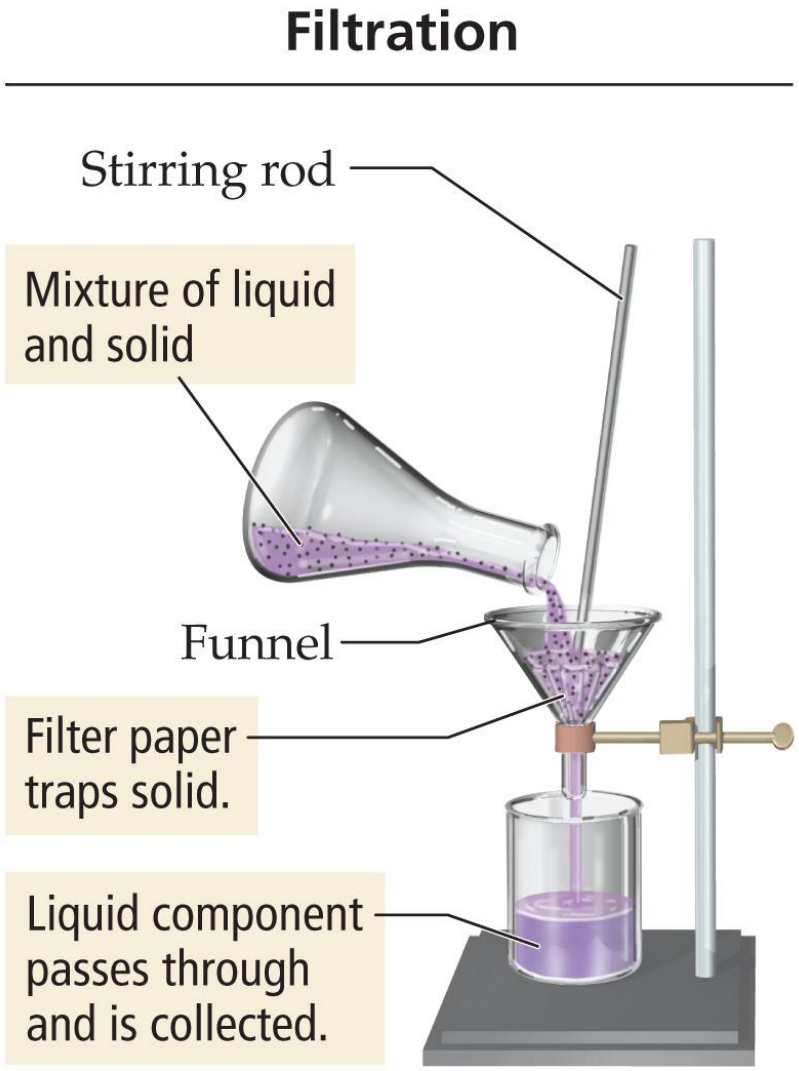
Separating Mixtures

- A mixture of sand and water, or oil and water, can be separated by **<u>decanting</u>**—carefully pouring off the water into another container.



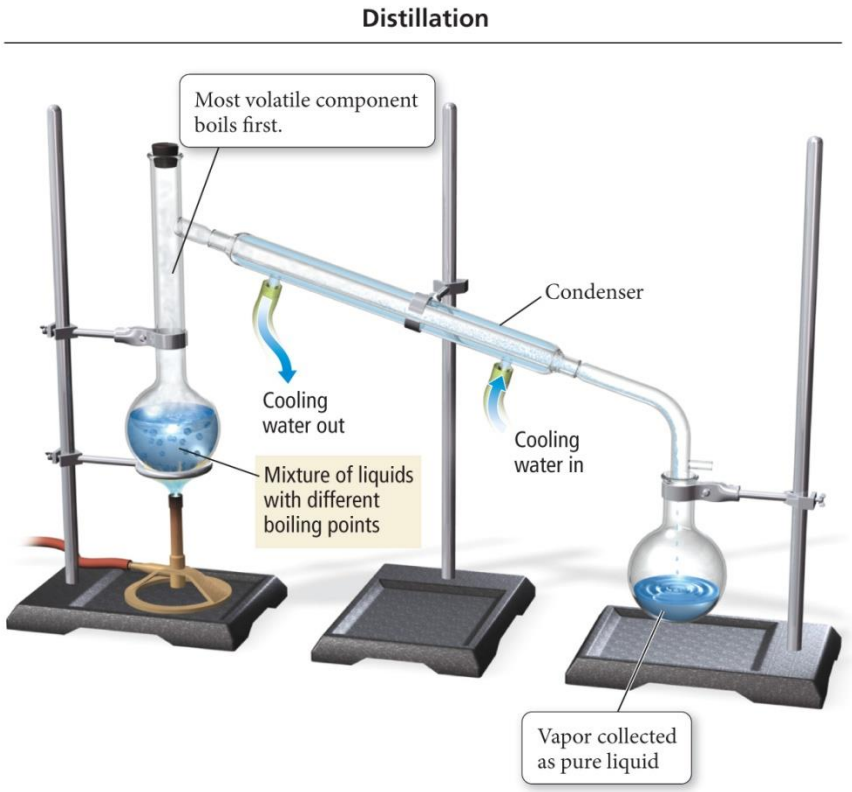
Separating Mixtures

- A mixture of an insoluble solid and a liquid can be separated by **filtration**—process in which the mixture is poured through filter paper in a funnel.

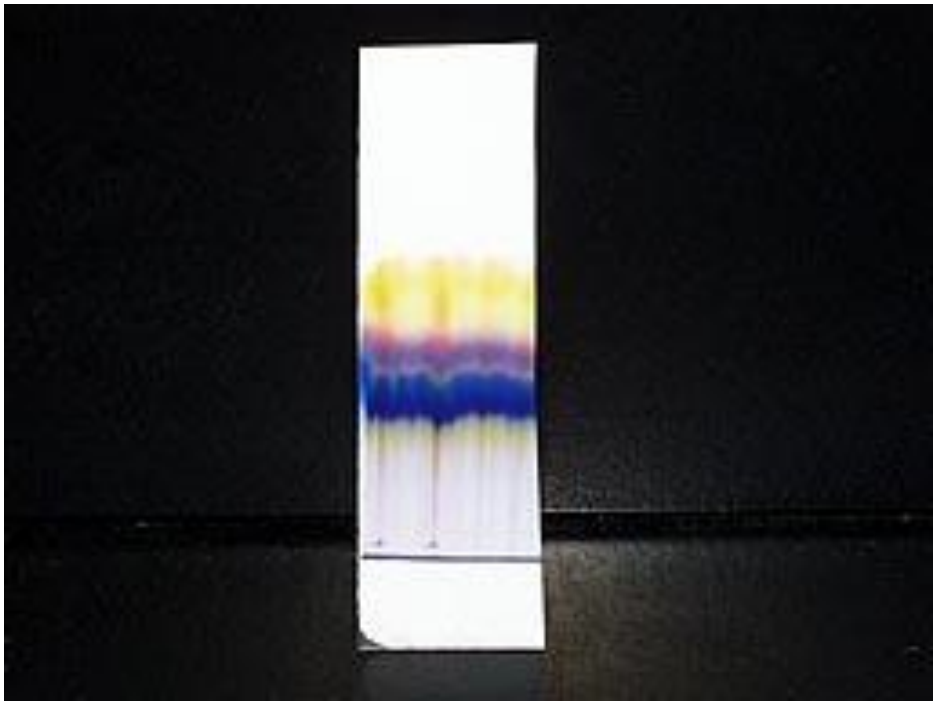


Separating Mixtures

- A homogeneous mixture of liquids can usually be separated by **distillation,**
- Mixture is heated to boil off the more **volatile** (easily vaporizable) liquid.
- The volatile liquid is then re-condensed in a condenser and collected in a separate flask.



Separation of a Mixture



- The components of dyes such as ink may be separated by paper **chromatography**

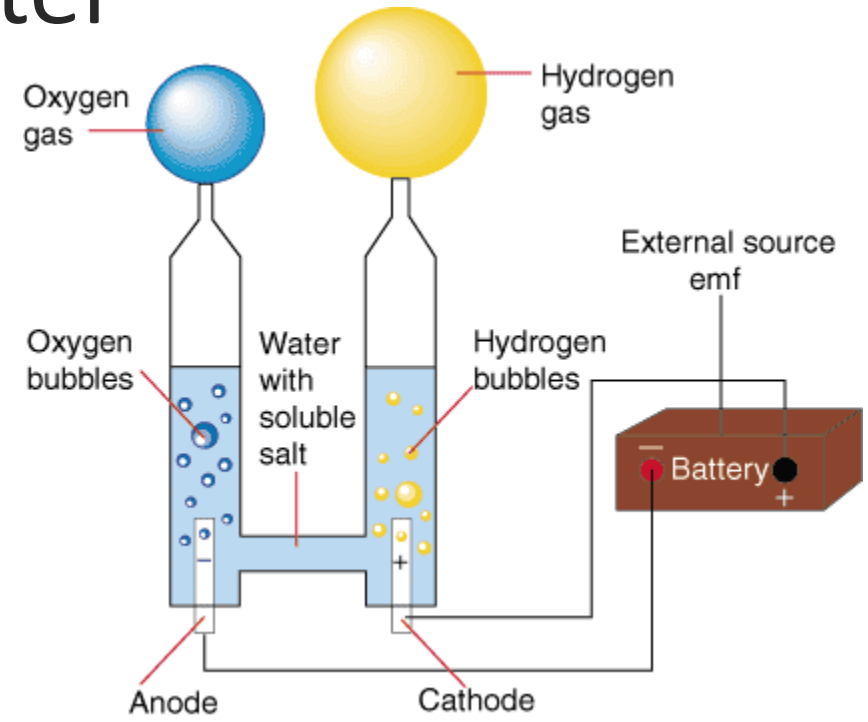
- Some elements can travel further up the paper than others

Separation of a Molecule/Compound

The Electrolysis of water

Compounds must be separated by **chemical means.**

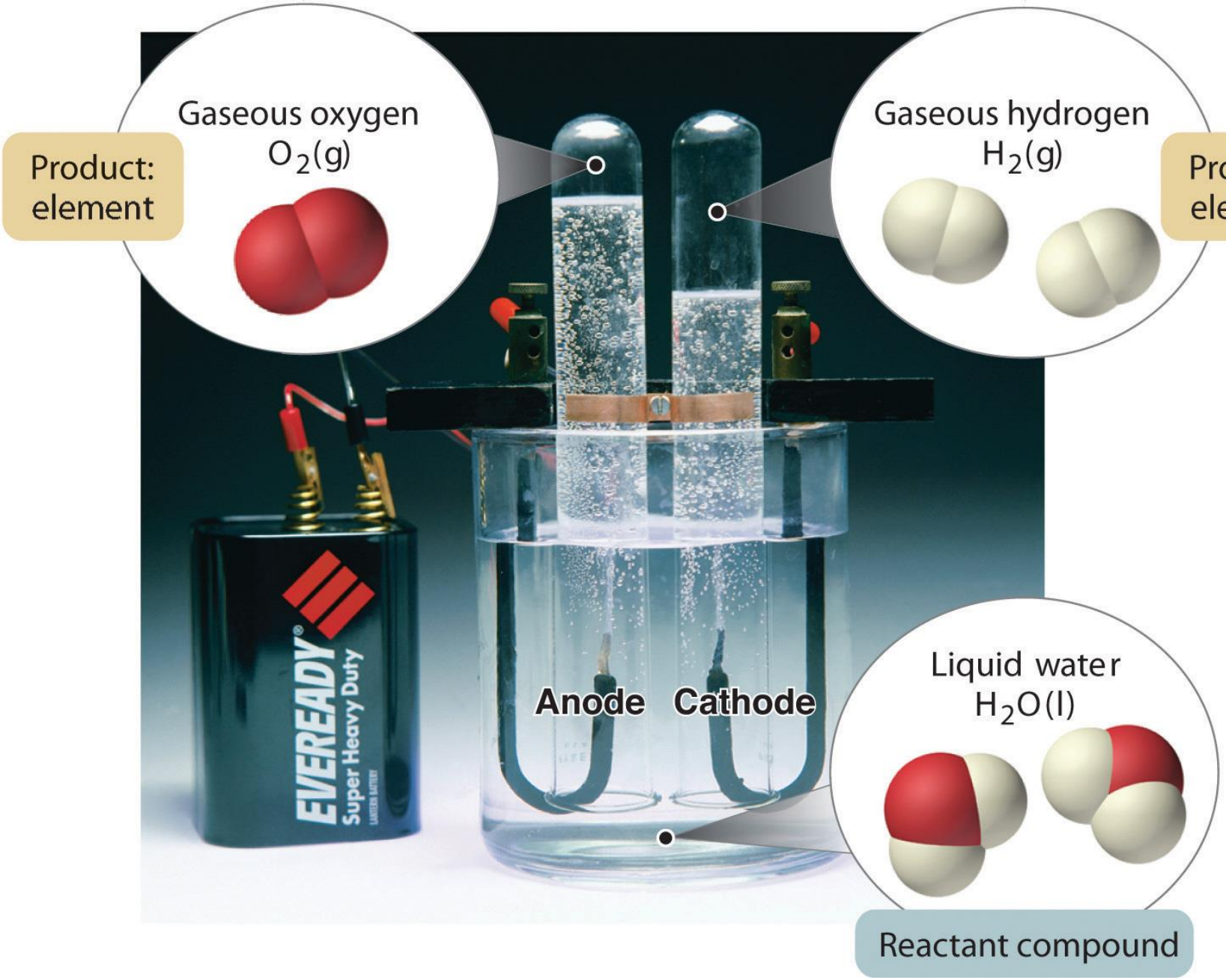
With the application of electricity, water can be separated into its elements



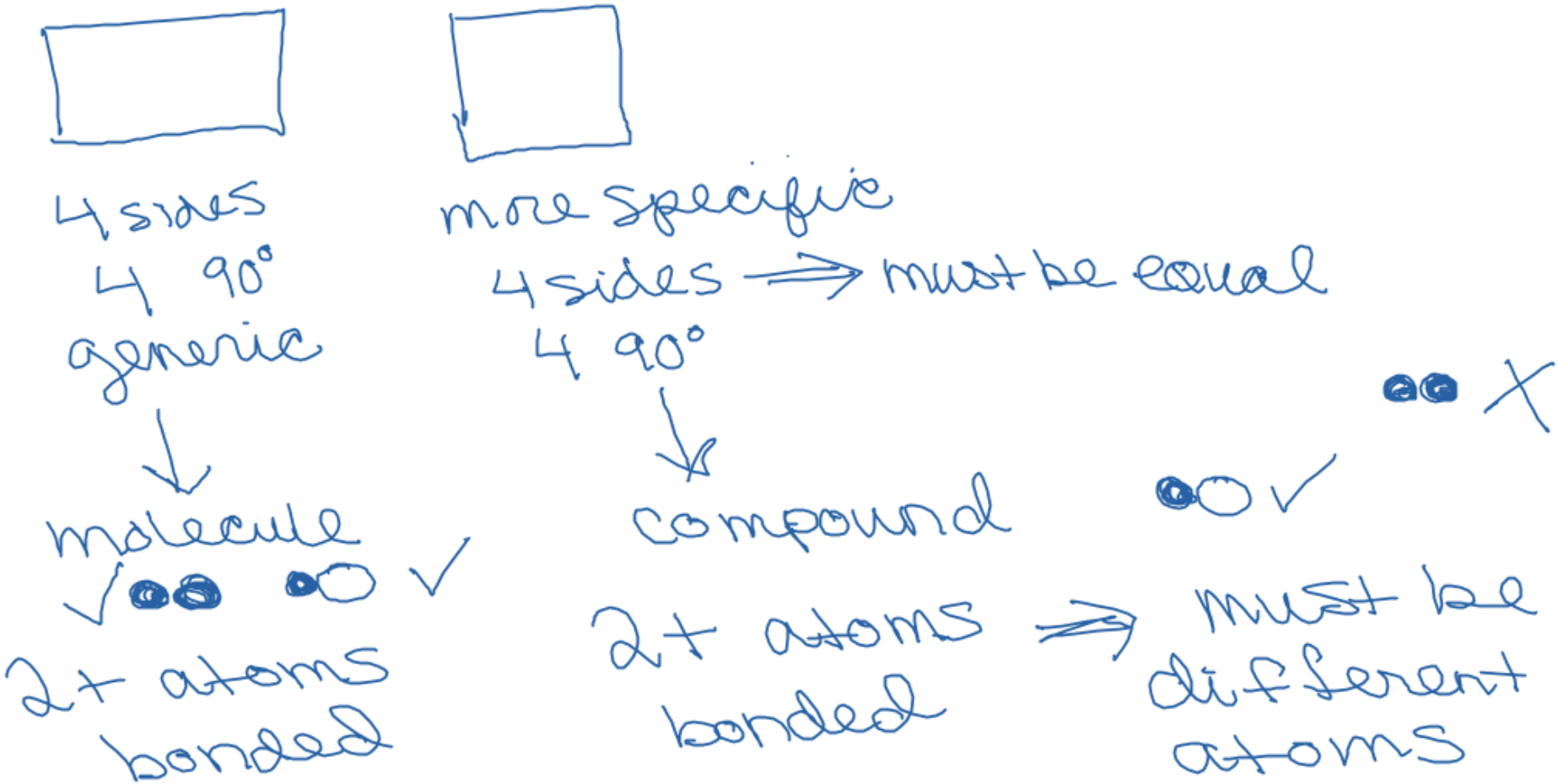
Reactant → Products

Water → Hydrogen + Oxygen

$2H_2O \rightarrow 2H_2 + O_2$


Product: element
Gaseous oxygen
$O_2(g)$
Gaseous hydrogen
$H_2(g)$
Product: element
EVEREADY
Super Heavy Duty
Anode
Cathode
Liquid water
$H_2O(l)$
Reactant compound

Extra Help about molecules vs. compounds using the "Rectangle versus square" analogy



Link to YouTube Video of Presentation:

https://youtu.be/gQ64-kFWW_Q