

N4 – Properties, Changes, and Types of Matter

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

Link to YouTube Presentation: https://youtu.be/gQ64-kFWW_Q

Properties of Matter

Extensive properties

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

Intensive properties

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

- Volume
- Mass
- Energy Content
(think Calories)

- Melting point
- Boiling point
- Density

Which of the following is
an **EXTENSIVE** property?

AMOUNT

- A** It is a solid at 25 °C.
- B** It has a density of 1.38 g/cm³.
- C** It melts at 62.0 °C.
- D** It has a volume of 0.52 cm³.
- E** It is shiny.

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- D** *It has a volume of 0.52 cm³.*
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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

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Melting Point



Combustible



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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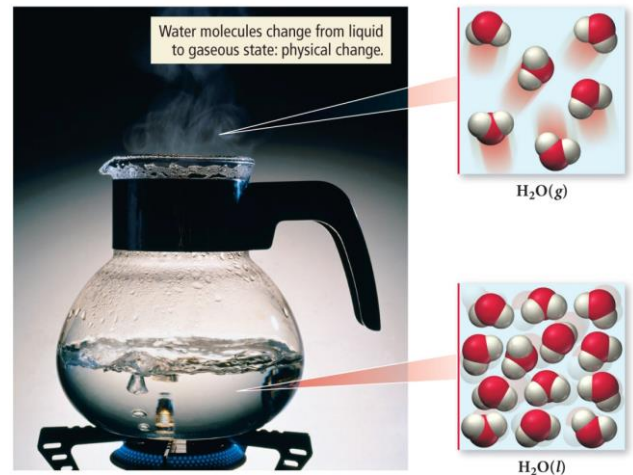
Types of Changes

Physical Change

Chemical Change

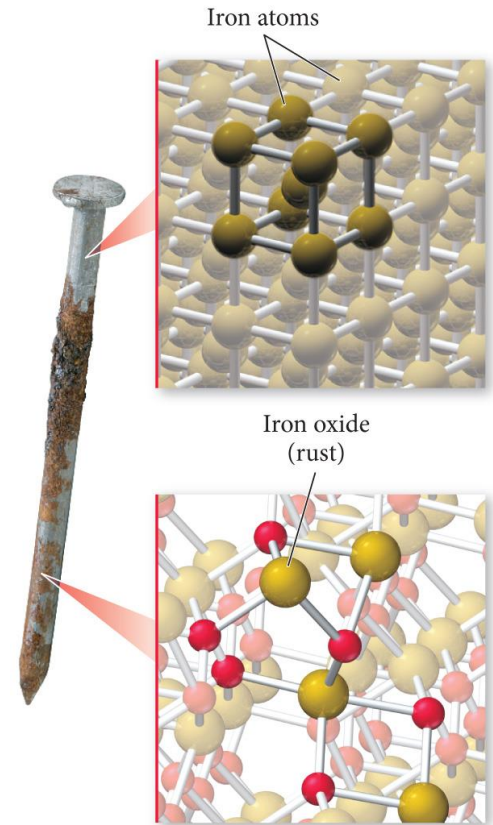
Physical Change

- 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”*

PERIODIC TABLE OF ELEMENTS

1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Caesium	56 Ba Barium	57 La Lanthanum	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89 Ac Actinium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson






H-7

* 58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium
** 90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium






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?

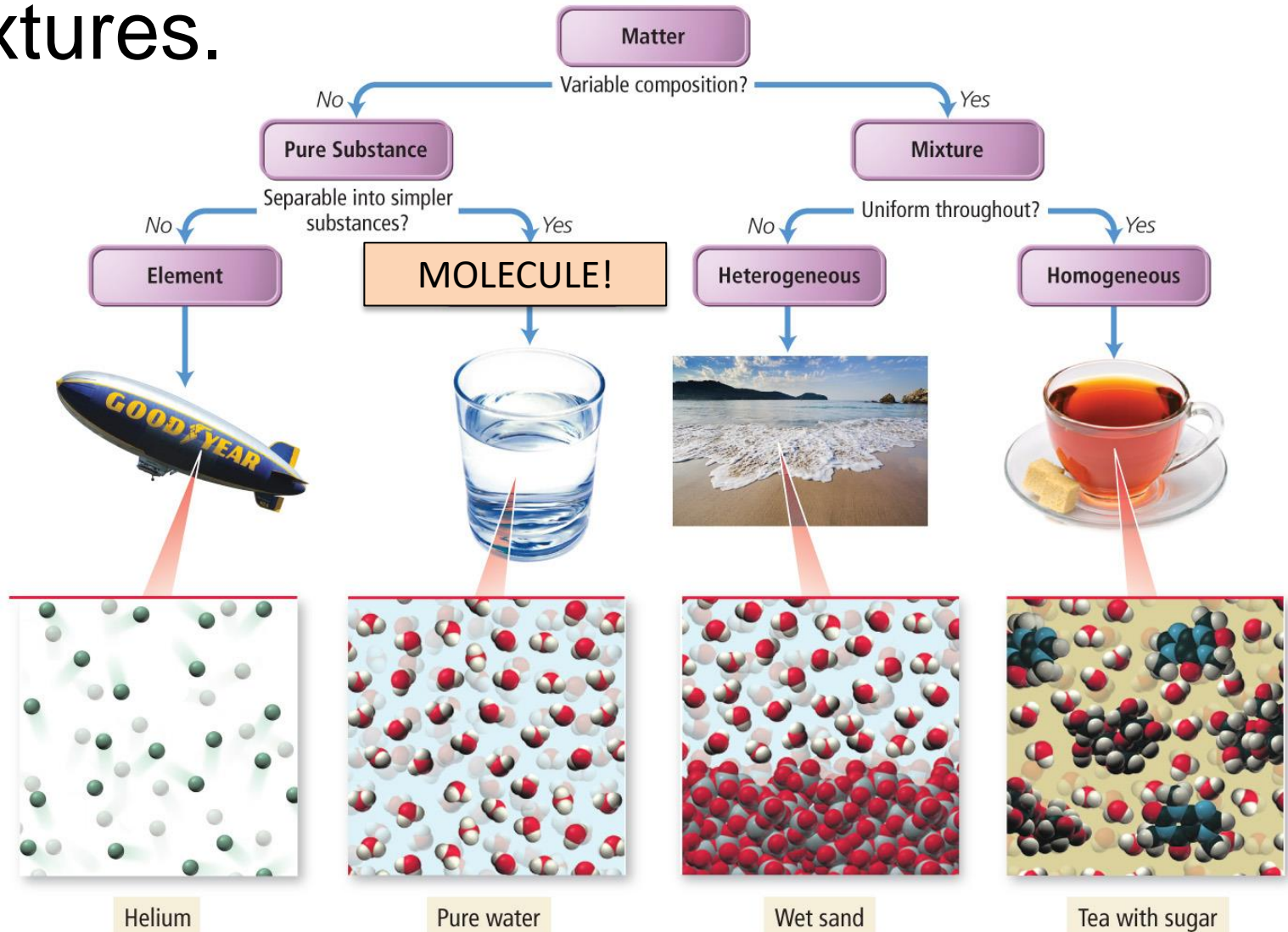
-  **A** Kool-aid
-  **B** Coffee
-  **C** A latte
-  **D** Hydrogen peroxide
-  **E** Ice

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.

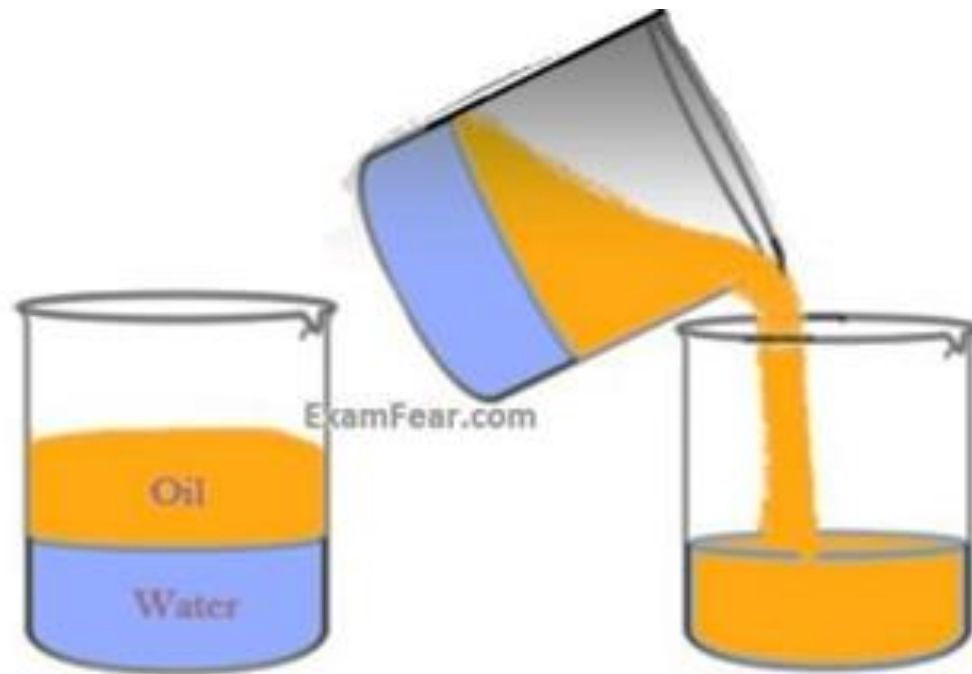


Separating Mixtures

- 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 **decanting**—carefully pouring off the water into another container.

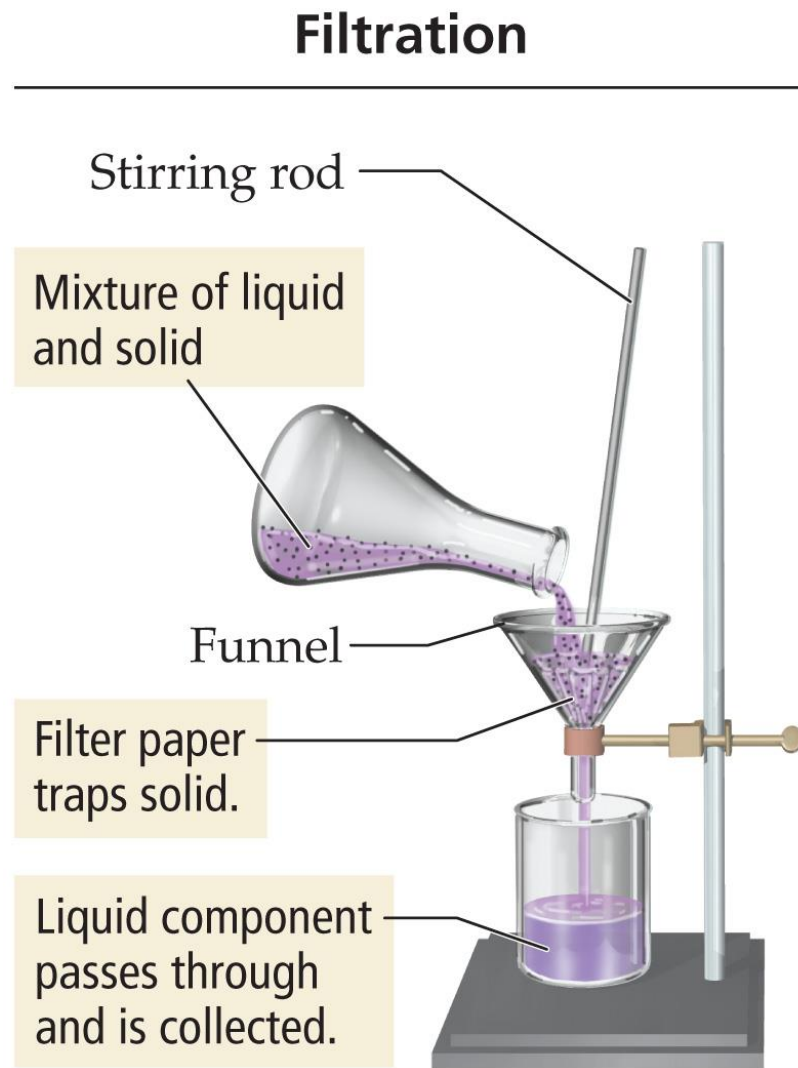


Mixture of oil and water.

Oil is separated from water

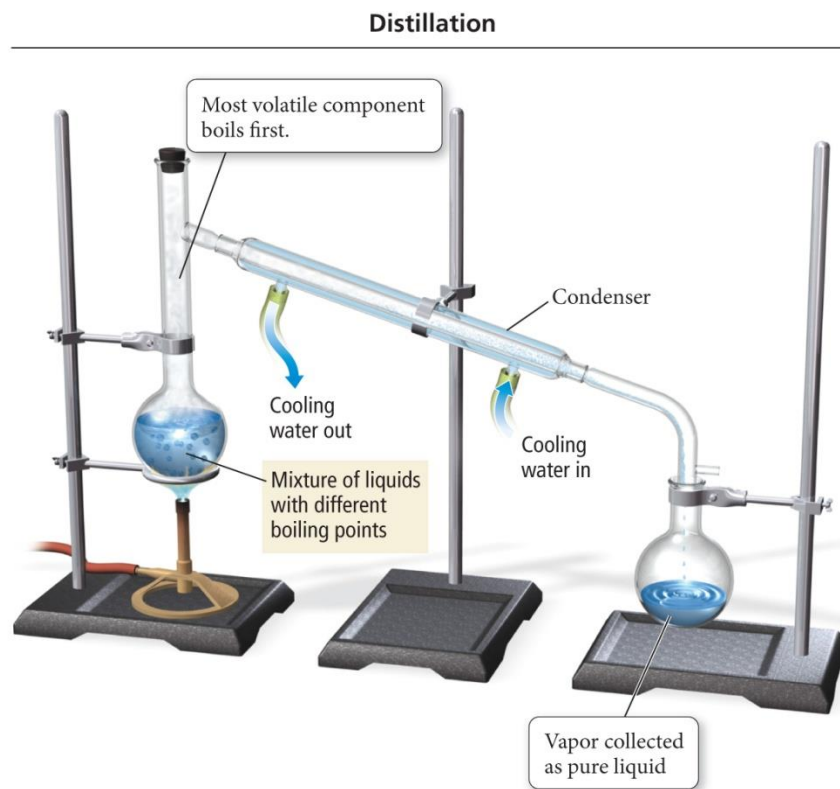
Separating Mixtures

- 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.

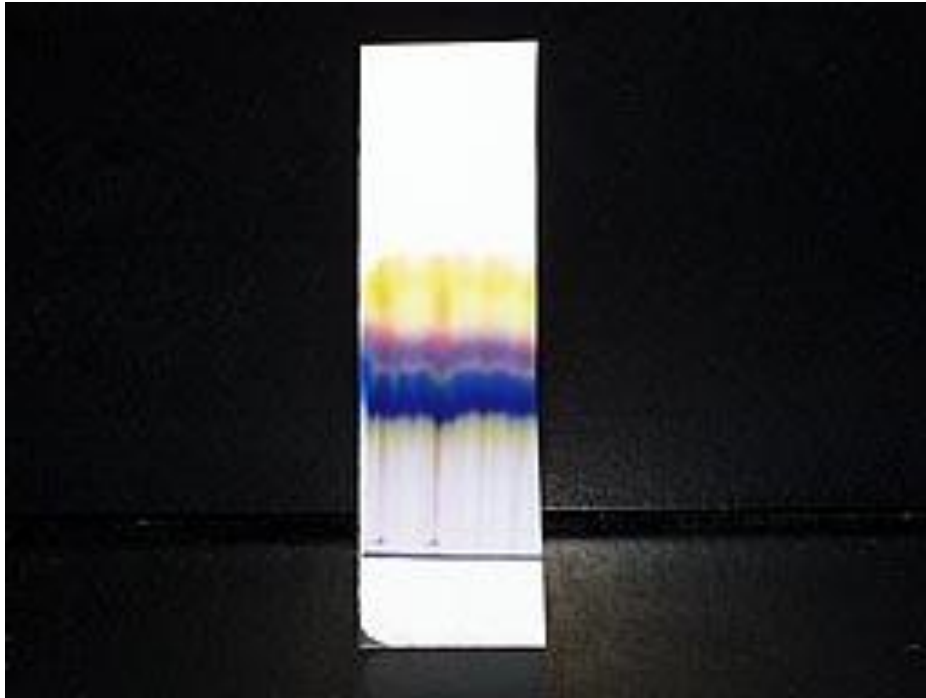


Separating Mixtures

- 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



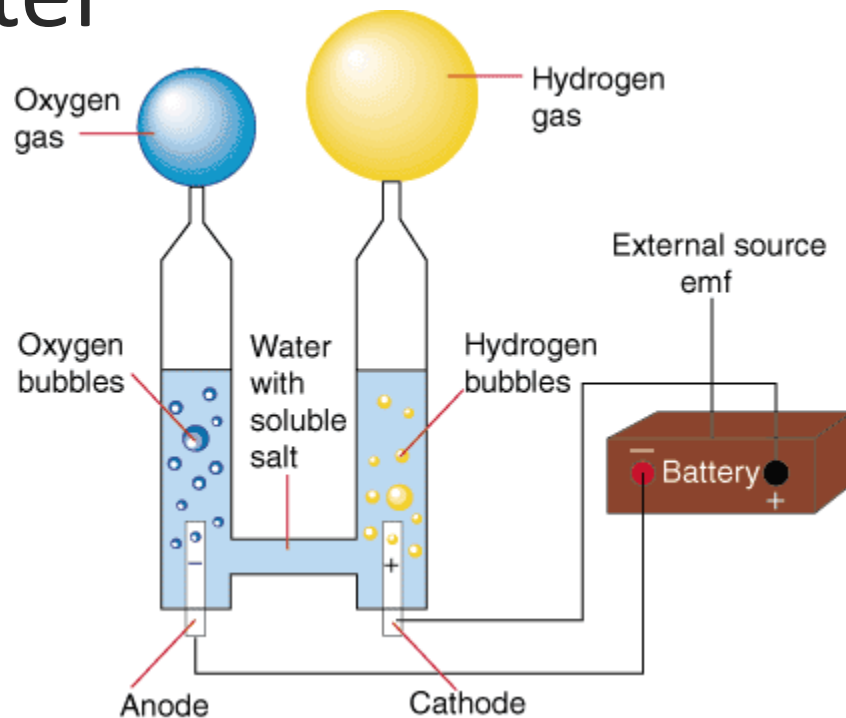
- The components of dyes such as ink may be separated by paper chromatography
- Some elements can travel further up the paper than others

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



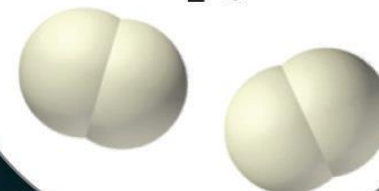
Gaseous oxygen
 $O_2(g)$

Product:
element

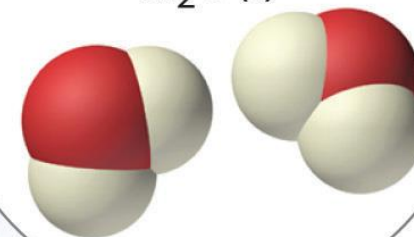


Gaseous hydrogen
 $H_2(g)$

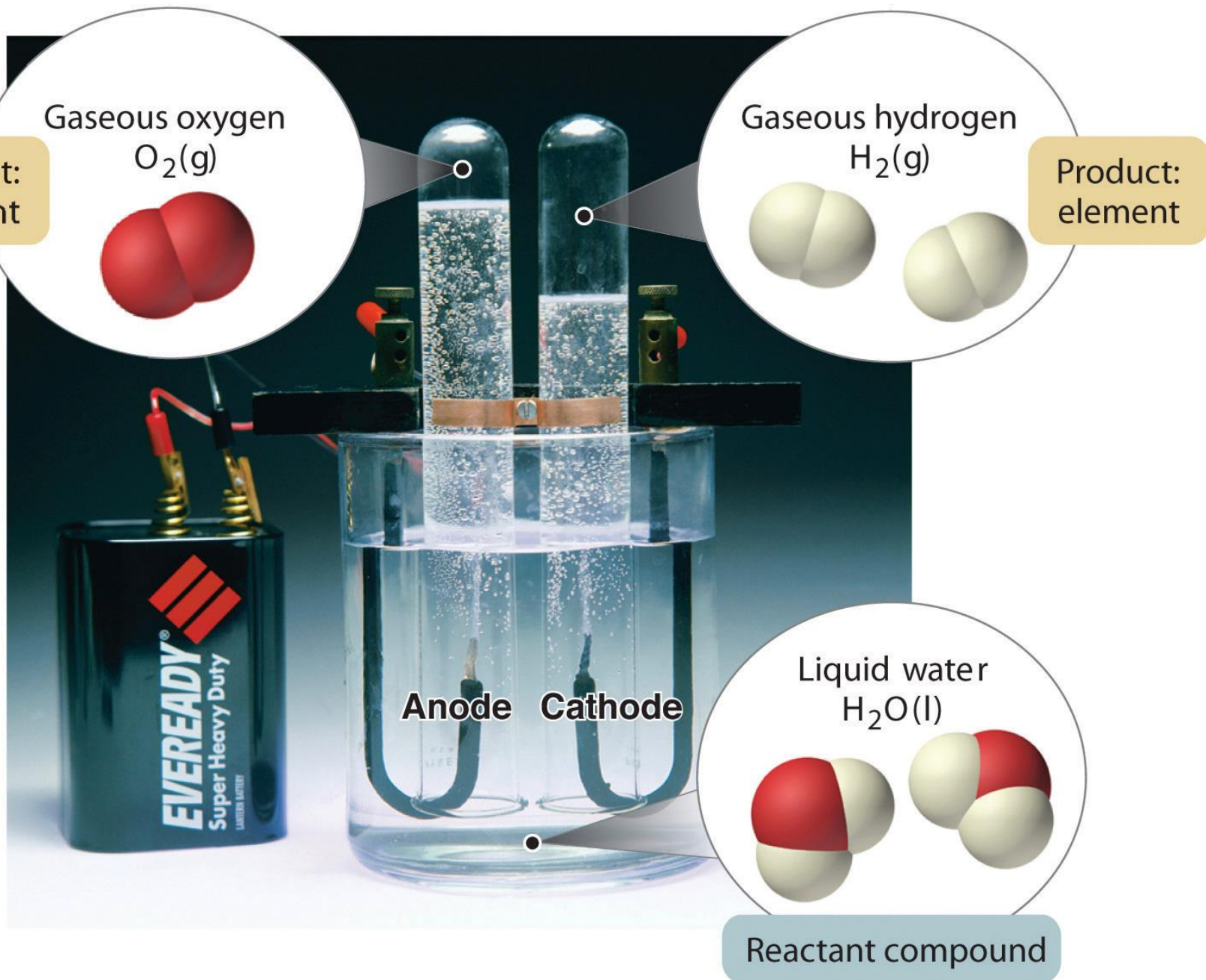
Product:
element



Liquid water
 $H_2O(l)$



Reactant compound



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



4 sides
4 90°
generic



molecule



2+ atoms
bonded



more specific

4 sides \Rightarrow must be equal
4 90°



compound

2+ atoms
bonded



must be
different
atoms



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