

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

- 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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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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Hardness



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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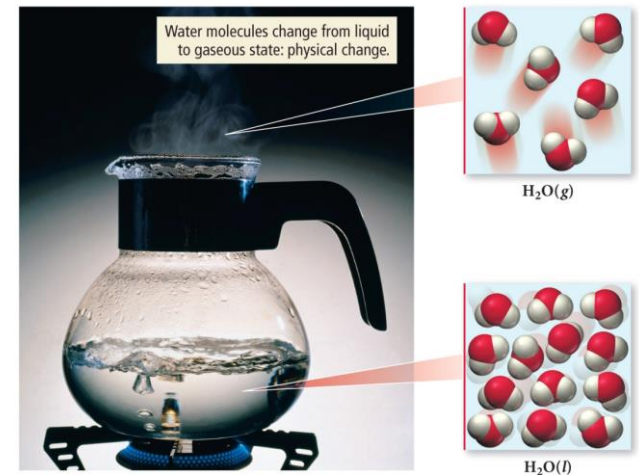
Types of Changes

Physical Change

Chemical Change

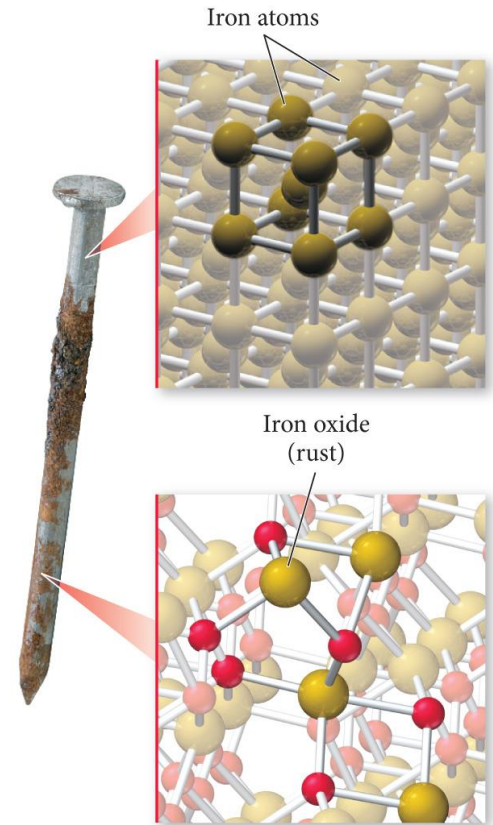
Physical Change

- 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

- **Careful!**

- | | |
|---------------|---------------|
| H_2 | <i>Horses</i> |
| N_2 | <i>Need</i> |
| O_2 | <i>Oats</i> |
| F_2 | <i>For</i> |
| Cl_2 | <i>Clear</i> |
| Br_2 | <i>Brown</i> |
| I_2 | <i>“Eyes”</i> |

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
Aluminum

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
Cesium

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

* 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

H-7






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?

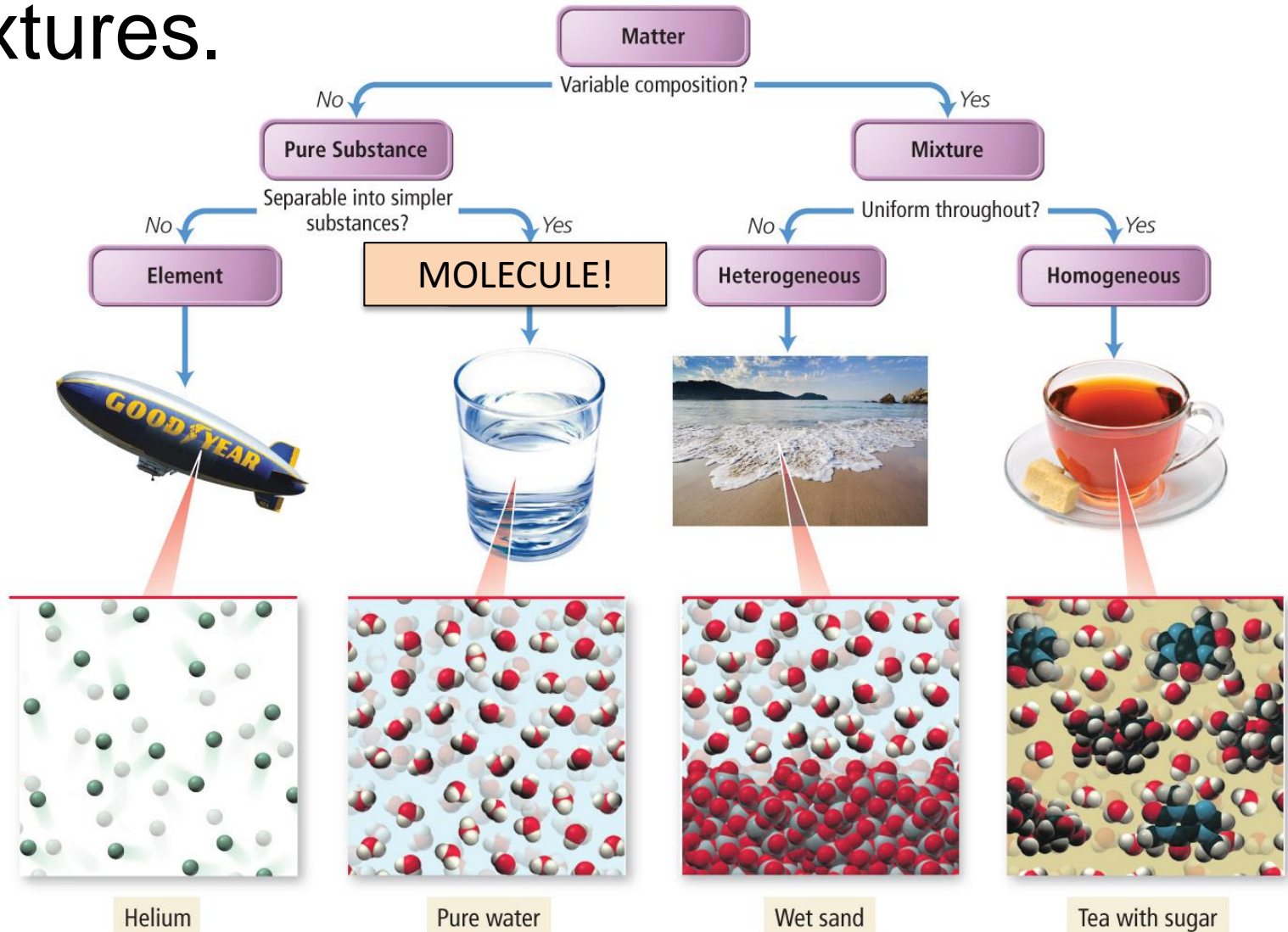
-  **A** Kool-aid
-  **B** Coffee
-  **C** A latte
-  **D** Hydrogen peroxide
-  **E** Ice

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.

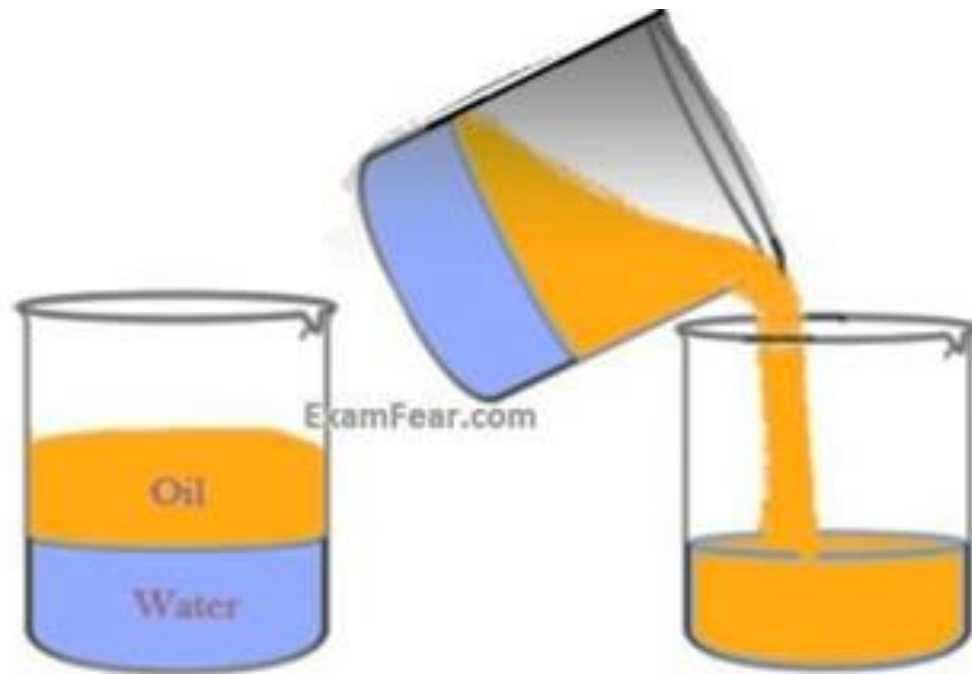


Separating Mixtures

- 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.

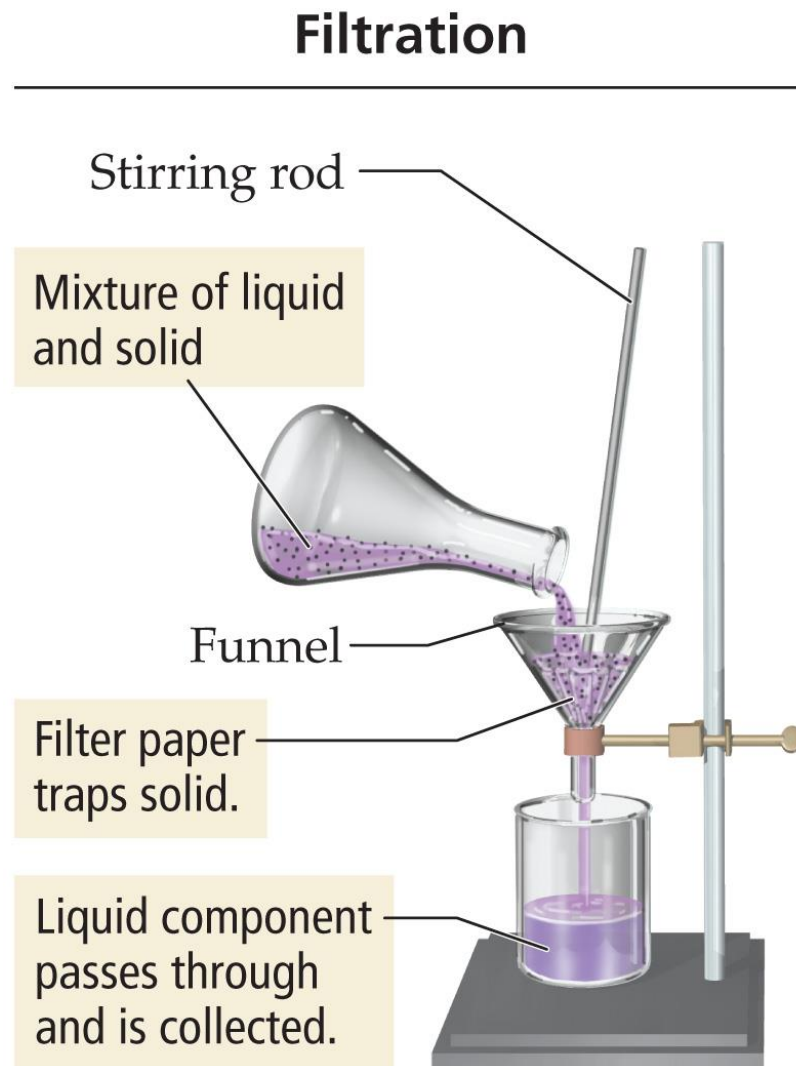


Mixture of oil and water.

Oil is separated from water

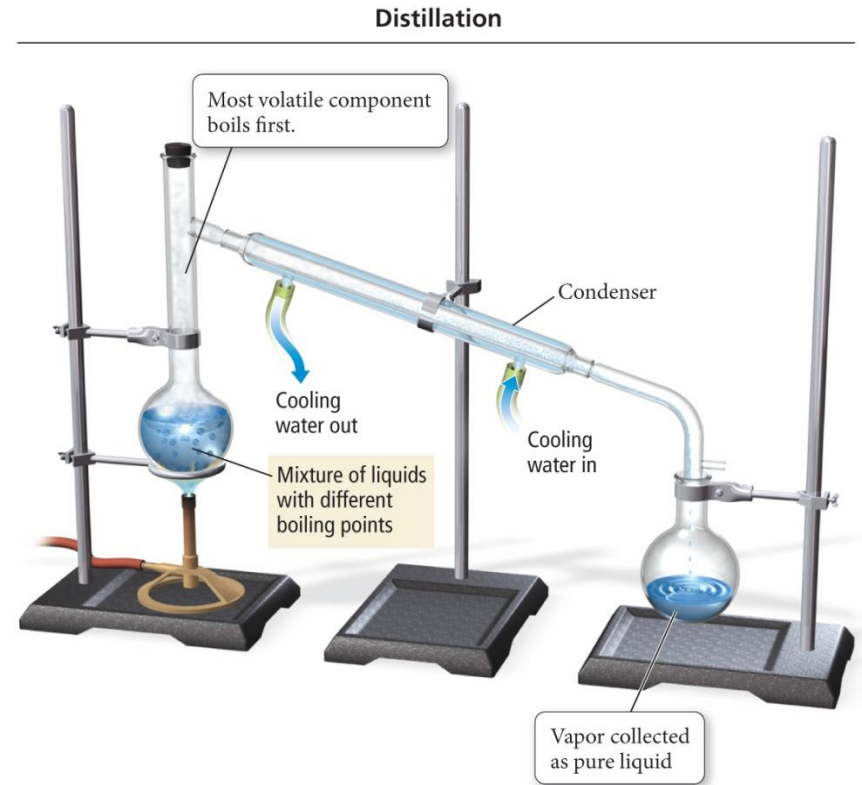
Separating Mixtures

- 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.

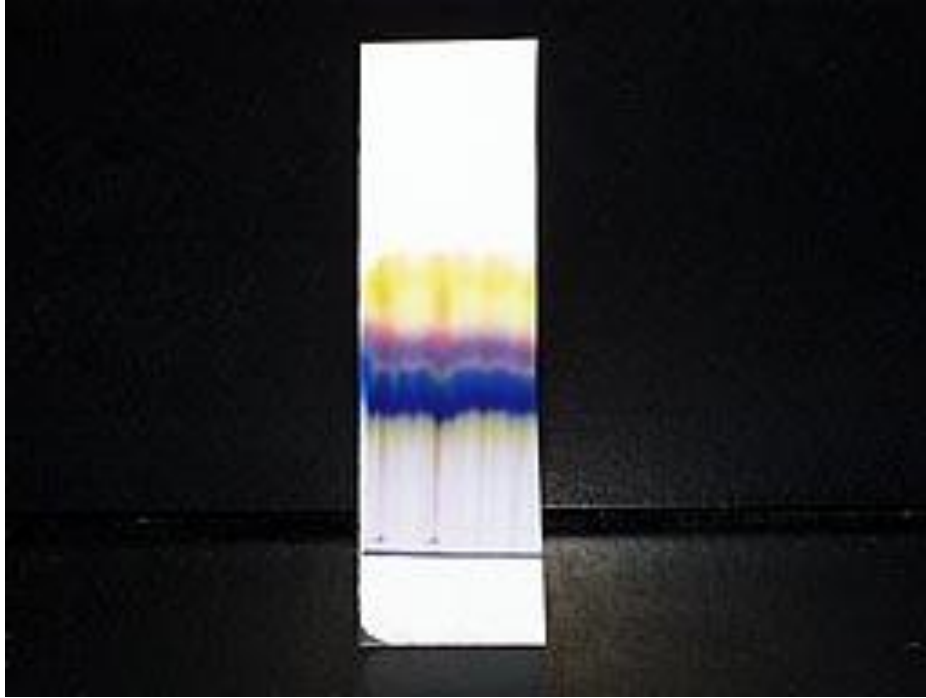


Separating Mixtures

- 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



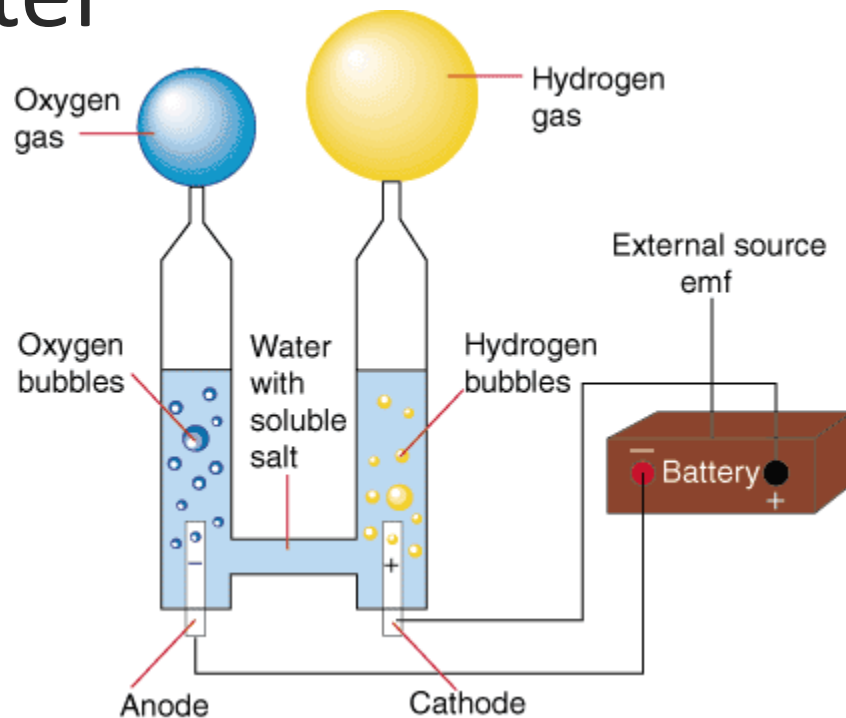
- The components of dyes such as ink may be separated by paper chromatography
- Some elements can travel further up the paper than others

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

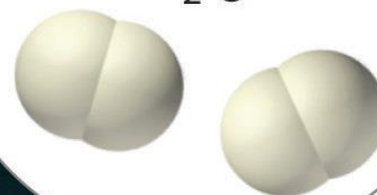


Product:
element

Gaseous oxygen
 $\text{O}_2(\text{g})$

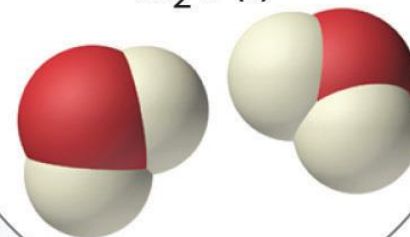


Gaseous hydrogen
 $\text{H}_2(\text{g})$

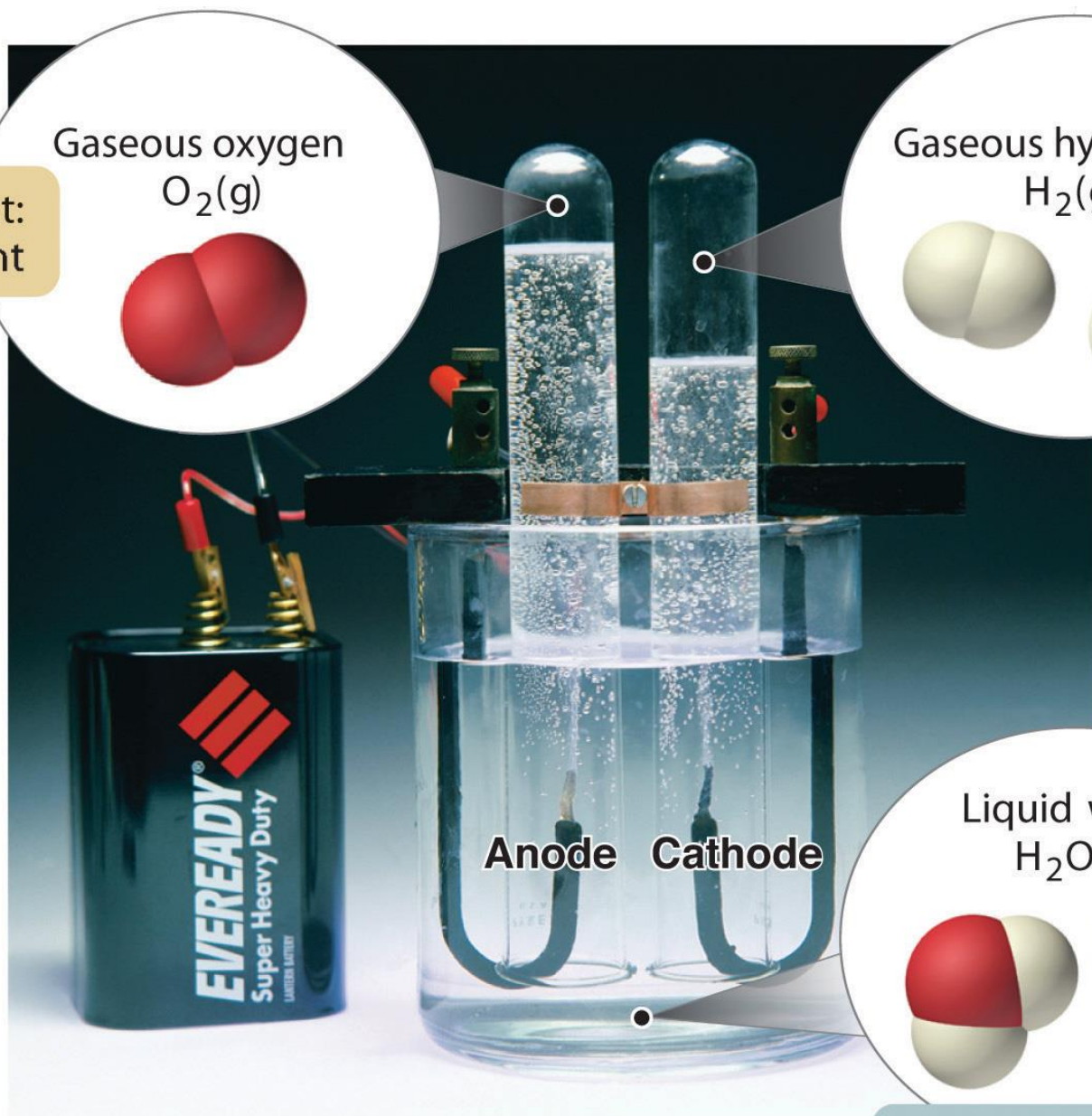


Product:
element

Liquid water
 $\text{H}_2\text{O}(\text{l})$



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



Link to YouTube Video of Presentation:

https://youtu.be/gQ64-kFWW_Q