



# Chapter 17

## Lesson 2

# Physical Properties

- A characteristic of a substance that can be observed without changing its identity.
  - can be used to separate mixtures
  - EX: color, shape, size, density, melting point, and boiling point, magnetism

# Appearance

- How would you describe a tennis ball? You could begin by describing its shape, color, and state of matter.
- You can measure some physical properties, too. For instance, you could measure the diameter of the ball



# Behavior



# Using Physical Properties to Separate

- The magnet attracts only the iron filings and pulls them from the sand. This is an example of how a physical property, such as magnetic attraction, can be used to separate substances in a mixture.



# Physical Change

- A change in size, shape, or state of matter is called a physical change.
  - properties remain the same
  - reversible
  - can be used to separate mixtures
  - EX: dissolving, grinding, mixing sugar and salt

# The Identity Remains the Same

- Iron is a substance that can change states if it absorbs or releases enough energy—at high temperatures, it melts.
- Color changes can accompany a physical change, too.



# The Identity Remains the Same

- For example, when iron is heated it first glows red. Then, if it is heated to a higher temperature, it turns white.





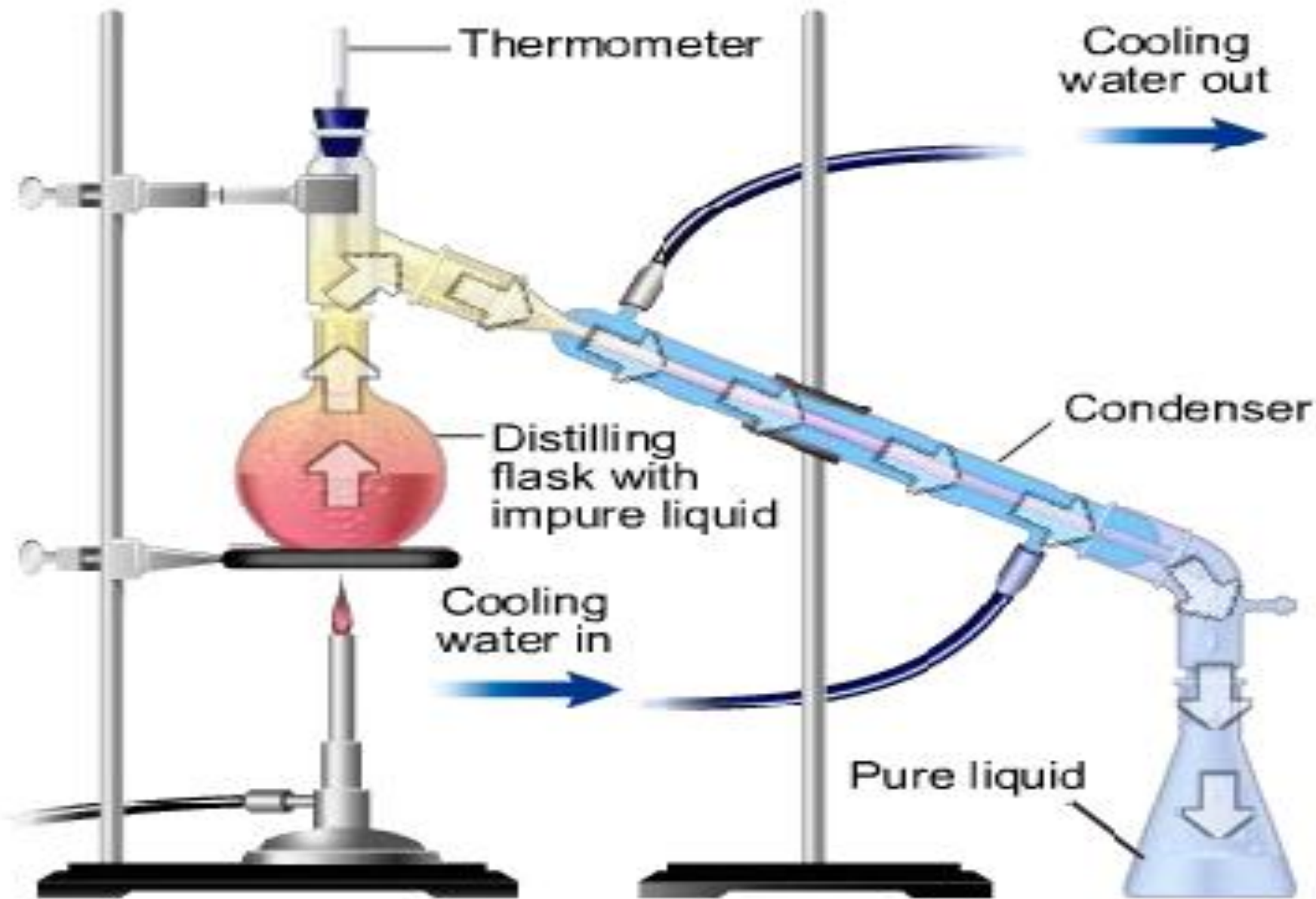
# Using Physical Change to Separate

- Many such areas that lie close to the sea obtain drinking water by using physical properties of water to separate it from the salt.
- One of these methods, which uses the property of boiling point, is a type of distillation.

# Distillation



- The process for separating substances in a mixture by evaporating a liquid and recondensing its vapor is distillation
- It usually is done in the laboratory using an apparatus similar to that shown.



# Chemical Properties

- Characteristic of a substance that indicates whether it can undergo a certain chemical change
  - Reactivity, flammability
  - Signs: color change, formation of a gas/solid, release of light/heat
  - EX: reactivity with oxygen, oxygen's combustibility, a diamond's resistance to corrosion

# Chemical Change

- A change of one substance to another is a chemical change.
  - properties change
  - irreversible
  - Signs: color change, formation of a gas/solid, release of light/heat
  - EX: burning, rusting



# The Identity Changes

- Clues such as heat, cooling, or the formation of bubbles or solids in a liquid are helpful indicators that a reaction is taking place.
- However, the only sure proof is that a new substance is produced.
- The only clue that iron has changed into a new substance is the presence of rust.

# Using Chemical Change to Separate

- One case where you might separate substances using a chemical change is in cleaning tarnished silver.
- Tarnish is a chemical reaction between silver metal and sulfur compounds in the air which results in silver sulfide
- It can be changed back into silver using a chemical reaction.



# Using Chemical Change to Separate

- You don't usually separate substances using chemical changes in the home.
- In industry and chemical laboratories, however, this kind of separation is common. For example, many metals are separated from their ores and then purified using chemical changes.

# Weathering—Chemical or Physical Change?

- The forces of nature continuously shape Earth's surface. Rocks split, deep canyons are carved out, sand dunes shift, and curious limestone formations decorate caves.
- Do you think these changes, often referred to as weathering, are physical or chemical?
- The answer is both.

# Physical



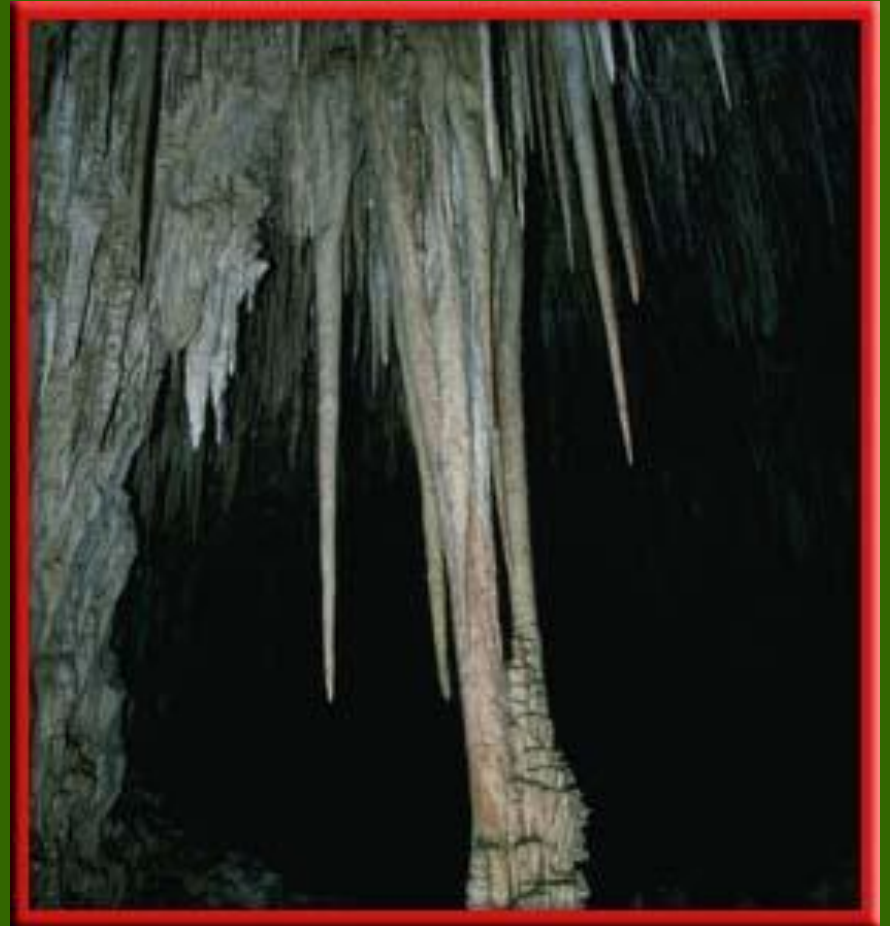
- Large rocks can split when water seeps into small cracks, freezes, and expands.
- However, the smaller pieces of newly exposed rock still have the same properties as the original sample.
- This is a physical change.

# Chemical

- Solid calcium carbonate, a compound found in limestone, does not dissolve easily in water.
- However, when the water is even slightly acidic, as it is when it contains some dissolved carbon dioxide, calcium carbonate reacts.
- It changes into a new substance, calcium hydrogen carbonate, which does dissolve in water.

# Chemical

- A similar chemical change produces caves and the icicle shaped rock formations that often are found in them.



# The Conservation of Mass

- Suppose you burn a large log until nothing is left but a small pile of ashes.
- At first, you might think that matter was lost during this change because the pile of ashes looks much smaller than the log did.



# The Conservation of Mass

- In fact, the mass of the ashes is less than that of the log.



# The Conservation of Mass

- However, suppose that you could collect all the oxygen in the air that was combined with the log during the burning and all the smoke and gases that escaped from the burning log and measure their masses, too.
- Then you would find that no mass was lost after all.



# The Conservation of Mass

- Not only is no mass lost during burning, mass is not gained or lost during any chemical change.
- According to the law of conservation of mass, the mass of all substances that are present before a chemical change equals the mass of all the substances that remain after the change