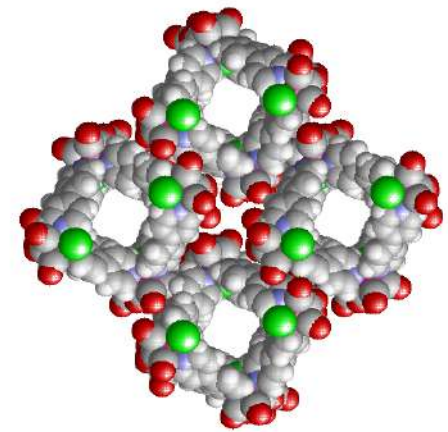


# Physical and Chemical Properties

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3<sup>rd</sup> period



# Physical properties



can be observed and measured without changing the kind of matter being studied. The following physical properties can be used to help identify a substance

# Melting Point



Melting Point is the temperature at which a solid can change to a liquid.

The temperature at which a pure substance melts is unchanging under constant conditions.

Therefore, the melting point of a pure substance can be used as a physical property for identification. Ice melts to form liquid water at  $00\text{C}$  ( $32\text{oF}$ ).

# Boiling point



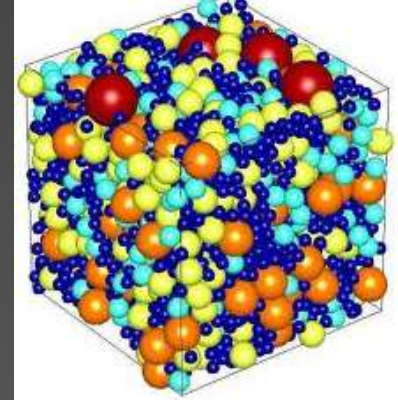
Boiling begins when the liquid starts to form bubbles throughout, which grow larger, rise to the surface, and burst.

As long as the substance is boiling the temperature of the liquid remains constant (at the boiling point).

Boiling point is unchanging under constant conditions for a given substance and therefore can be used as a physical property for identification of the substance.

The boiling

# Density



- is a property that describes the relationship between the mass of a material and its volume.
- Substances that have higher densities contain more matter in a given volume
- The density of a substance will stay the same no matter how large or small the sample of the substance, and therefore, density can be used as a physical property for identification of the substance.
- For example, the density of lead is much greater than the density of aluminum

# Color



- can be used to help identify a substance, along with other properties.
- ○ By itself color is not a significant identifier of a substance.
- ○ Absence of color is also a physical property.

# Chemical Properties



- can also be used to help identify a substance. Chemical properties can be recognized only when substances react or do not react chemically with one another, that is, when they undergo a change in composition. A chemical property of one substance usually involves its ability to react or not react with another specific substance. Two examples of chemical properties include:

# Reacting with oxygen



- The ability of a substance to burn is a chemical property that involves a substance reacting quickly with oxygen to produce light and heat. Reacting with oxygen slowly occurs when iron rusts or apples turn brown.



# Reacting with Acids



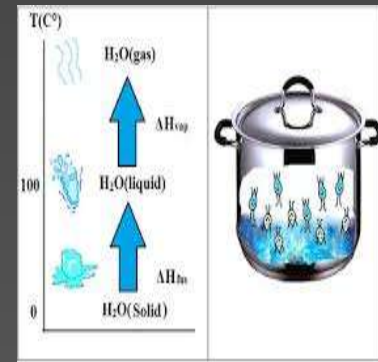
- The ability of a substance to react with an acid is a chemical property. Some metals react with various acids to form compounds. All metals do not react with all acids. Bases react with acids to form water and neutralize the acid.

# Physical changes



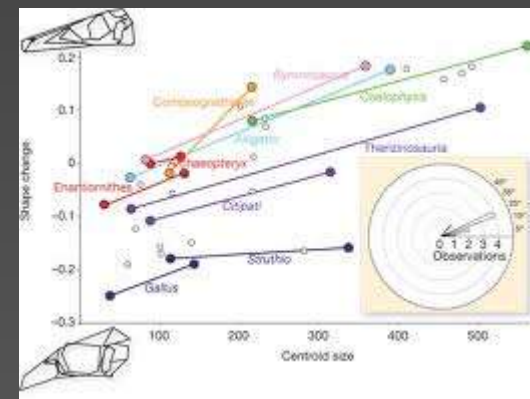
- do not change the composition of a substance, only the physical properties. Evidences of a physical change include:

# Change in state of matter



- When a substance changes from one state of matter to another (for example, changing from solid to liquid, from liquid to solid, or from liquid to gas), the composition of the substance remains the same.
- ○ Examples of change in state might include: melting of ice cream, hardening of melted wax, or evaporating of water from wet clothes.
- ○ When a substance changes directly from a gas to a solid (the forming of frost from water vapor) or from a solid to a gas (dry ice, solid air fresheners) that change of state is called sublimation. This is still a physical change because the composition of the substance remains the same.

# Change in size or shape



- When a substance changes in size or shape (for example, cutting, tearing, dissolving, stretching, or wrinkling), its composition remains the same. Examples of change in size or shape might include: shredding paper, dissolving sugar in water, stretching a rubber band, wadding up a piece of paper, or denting a piece of metal.

# Chemical changes



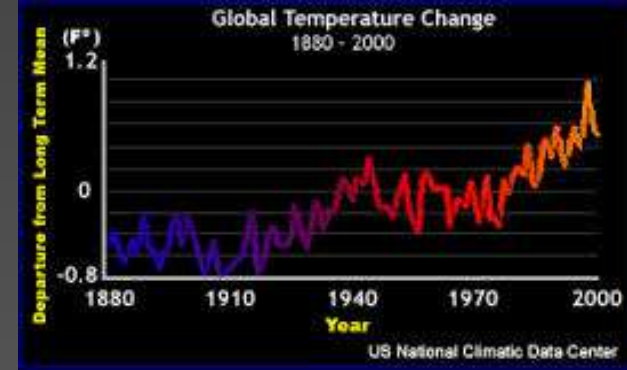
- result in the formation of one or more new substances with new chemical and physical properties. Evidences that a chemical change may have occurred include:

# Color change



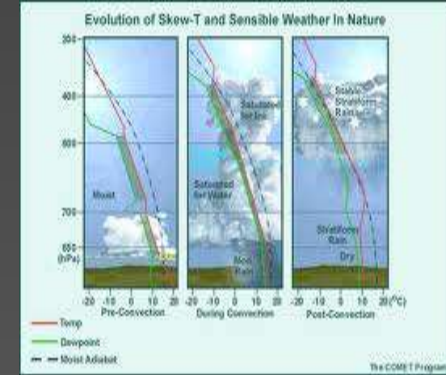
- When a substance changes color, the chemical composition of the substance may have changed (for example, iron turns to a reddish-brown when it rusts, apples brown when they react with oxygen in the air, or marshmallows turn black when burned).
- It is possible to have a color change without a chemical change (for example, adding food coloring to water).

# Temperature change



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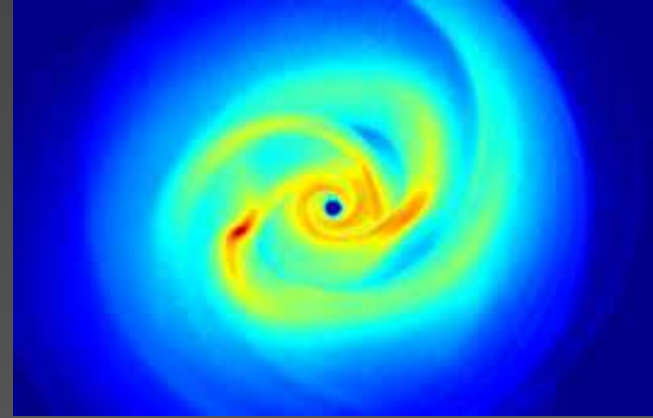
# Formation of a precipitate



- When two solutions are combined, they may form a solid substance. This solid substance is called a precipitate and indicates that a chemical change has occurred.
- For example when carbon dioxide is combined with aqueous calcium hydroxide (limewater), solid calcium carbonate (chalk) is formed as the precipitate.
- The precipitate may be in the form of very small particles, appearing as cloudiness in the solution or as a solid which settles to the bottom of the container.



# Formation of a gas



- When solid or liquid substances are combined, they may form gas bubbles.
- ○ The formation of the gas may indicate that a chemical reaction has taken place. For example when vinegar is added to baking soda, it forms carbon dioxide bubbles.
- ○ It is possible to form gas without a chemical change (for example, when water is heated to boiling).