

Lesson 3: Chemical vs. Physical Changes

Motivator:

Carbon tree demo: Take several scoops of sugar and enough concentrated sulfuric acid to cover the sugar. Do this in the fume hood.

Oral:

Q – What evidence is there that a new substance(s) has formed?

Demo some physical changes: rip some paper, stretch an elastic, melt some ice (one cube on a sheet of metal and one on a block of wood to reinforce the concept of conductors of heat), etc.

Q – What evidence is there that a new substance has NOT formed?

Notes:

Chemical change (also called chemical reaction) – when a substance reacts to produce a new substance(s) with new properties. Some chemical reactions are difficult to reverse. e.g., turning ash from a fire back into wood. Some chemical reactions are very easy to reverse. e.g., recharging a battery.

Evidence that a chemical change may have occurred:

1. change in colour
2. bubbles (i.e., the formation of a gas)
3. heat /light is released or absorbed
4. a change in state may occur

Oral: *Q – Can you think of a chemical change that occurs in everyday life?*

Physical change – When a substance is altered but the properties of the substance remain the same. A change in state due to melting or boiling does not produce a new substance.

e.g., boiling water converts the liquid water into gas water (steam). The change is physical because the steam is still water. Freezing liquid water into ice (i.e., solid water) does not change the fact that it's still water.

Demo: Show students a chunk of dry Ice and discuss what it is.

Oral:

Q – What am I talking about when I refer to the states of matter?

Q – What am I talking about when I refer to a change in state?

You are responsible for knowing all of the terms that are associated with change of state. Note the term solidification is used for freezing. Freezing is a term used to describe the solidification of water.

s, changing from one state
 ie same throughout the
 different changes
 aid or liquid to gas
 quid or liquid to
 re 2, that some
 e versa, without
 or example,
 e, that the
 ed because

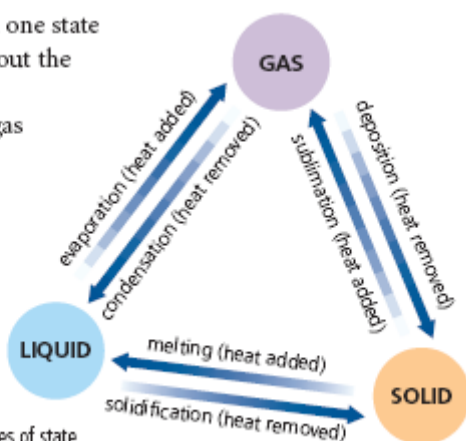


Figure 2 Changes of state

The way that chemists attempt to describe these changes in state is by using a theory called the kinetic molecular theory. KMT for short.

Kinetic molecular theory – states:

1. all matter is made up of tiny particles that are constantly in motion.
2. When particles are heated they move faster than when they are colder.
3. The attraction between particles is lower when they are further away and higher when they are close.
4. different substances are made up of different particles (i.e., different atoms or different molecules).

Table 2 The States of Matter and the Kinetic Molecular Theory

Solids Distance: particles close together Type of motion: particles can only vibrate in their place in the structure Attractive Forces: high, decreasing as vibrations get larger Energy: increasing energy causes an increase in vibration	 
Liquids Distance: particles close together Type of motion: particles still vibrate, but can now move past one another; can bump into each other and the sides of their container Attractive Forces: still quite high, but less than solids and decreasing with distance apart Energy: increase in energy causes an increase in vibration and movement	 
Gases Distance: particles very far apart Type of motion: particles vibrate, rotate, move past each other, and bump into each other in a very rapid straight line motion Attractive forces: no attractive forces; particles are too far apart and are moving too fast Energy: increase in energy causes an increase in pressure due to the increase in the speed and number of particles hitting the sides of the container	 

As particles heat up, the particles move faster and further away from each other. i.e., melting, evaporation, and sublimation are all changes in state that involve an increase in heat energy. The opposite situation occurs when substances are cooled down.

Oral:

Q – How can KMT explain how dissolving works?

A – Dissolved substances occupy the spaces in between water molecules. Hot water has the ability to dissolve substances faster because warmer particles move faster than cold ones.

Q – How can KMT explain changes in density?

A – An increase in temperature causes particles to spread out. This effectively increases the volume while the mass remains constant. While this effect is observed in all states of matter, this effect is very significant with gas systems b/c gases can expand to such a large degree.

If time allows: Demo “Topsy Turvy” from page 174.

Assign: Lesson 3 worksheet – chemical vs physical change