

## PHYSICAL STATES OF MATTER

In this section, we will discuss the Ideal Gas Laws. First, we will review the properties of solids, liquids, and gases. Second, we will discuss the kinetic-molecular theory of gases, which explains why they are so unique compared to other states of matter. Finally, we will discuss gas law equations, and practice using them to solve for different parameters. This unit has many strong connections to our daily lives as we are surrounded by examples of the materials we are studying. Our breathing depends on the gas laws we will be studying.

Particles are tightly packed in a set pattern, with a fixed volume and shape.	Solid
Particles are close together with no regular pattern of arrangements; has a set volume that will take the shape of the container it is placed in	Liquid
Particles are well separated with no arrangement, and does not have a set volume but rather adapts to the entire volume of the container it is placed in	Gas

## CHARACTERISTICS OF STATES OF MATTER

This is important in terms of chemical reactions, because particles must be in close proximity in order to react. In solids, the particles are closely packed together; the rigid conformity to their packed structure often prohibits extensive reactions, but nonetheless chemical reactions occur in the solid state. Most known chemical reactions take place in the liquid state, because the particles are closely interacting, but also have some flexibility of movement. Gases are unlike solid and liquids because the particles have very few interactions, and the interactions are transient.

Solid	Liquid	Gas
Fixed shape	No fixed shape	No fixed shape
Shape not set by container	Takes shape of filled portion of the container	Takes shape of container
Shape remains rigid	Can be poured	Fills container
Particles fixed in place but vibrate around a fixed position	Particles move past one another	Particles move through space
Little or no volume change under moderate pressure	Can be compressed slightly by moderate pressure	Compressed under moderate pressure
Little free space between particles	Some free space between particles	Particles are widely separated with much free space

Regardless, all states of matter are capable of chemical reactions. For example, solid wood can react with gaseous oxygen ( $O_2$ ) and a spark to create a fire, producing  $CO_2$  and  $H_2O$  gases.

The human body brings in gaseous oxygen ( $O_2$ ) which dissolves into liquid blood and expels gaseous  $CO_2$  as waste.

Oxygen **gas** is inhaled to the lungs, and brought into the blood, which is a **liquid**. Our bodies exchange the oxygen for carbon dioxide, which is a **gas**. The carbon dioxide is forced out of lungs by increasing the pressure of the lungs.