

Factors That Affect The Boiling Point Of A Liquid ,Boyle's Law and Charles's Law

If someone were to ask you what the boiling point of water was you would probably say 100 degrees Celsius. Is this always true however ?

Teacher Demonstration #1 (beaker of water in a bell jar with air removed)

In this first demo we have a beaker of water from the faucet with a thermometer in the beaker.

What is the temperature of the water? Temperature will vary from 25°-30°C

The beaker is then placed inside a Bell jar and the air is removed from the inside of the jar using a vacuum pump.

What does the water begin to do? It begins to boil

What is the temperature of the water now? the same or slightly lower than before

Based on this information we can conclude that as air pressure **decreases** the boiling point of a liquid, in this case water, **decreases** and vice versa.

Another factor that affects the boiling point of water is when a substance is dissolved in the water. Dissolving a substance in water **increases** the boiling point of water while at the same time it will **decrease** the freezing point of water.

If you travel to a higher altitude above sea level the air pressure around you will **decrease** because there's less air above you pushing on you. So the higher up you go, the **less** pressure there is, and the boiling point of a liquid like water will **decrease**.

This is the reason why when baking foods at higher altitudes where there is **less** air pressure, there is a different set of directions needed. For example , on the back or side panel of a box of brownie mix you'll find " High Altitude Cooking Directions " .

Teacher Demonstration #2(inflated balloon in a bell jar with air removed)

What affect does changing pressure have on the volume of a gas?

For this demonstration we will place a balloon inflated with air inside a Bell jar and begin to remove air from the jar. What happens to the size of the balloon as the air pressure inside the jar **decreases**?

it **increases or expands in size**

Based on this information we can conclude that as air pressure **decreases** the volume of the gas will **increase** and vice versa.

This is an example of an indirect relationship.

This relationship between pressure and volume of a gas is known as **Boyle's law**.

If you have ever flown in an airplane you know that as the plane begins taking off you begin to get some pain in your ear. This is because as you go higher up there is less air pressure and this causes the air space on the inner side the eardrum to expand and push the eardrum outward.

Charles's Law

The volume of a gas is also affected by the temperature. What follows are several examples of how the volume of a gas changes when the temperature is changed .

Example 1 When air is heated, as for a hot air balloon, the air **expands** filling the balloon.

Example 2 Automobile tires need more air put inside them as outside temperatures get colder, and need air released as the temperatures warm up. This shows that as temperature **decreases** the volume of the air inside the tires also **decreases** and vice versa.

Example 3 All aerosol cans have warnings on them regarding temperature such as " Do not store at temperature above 120 °F as container may burst ". The can would burst only if the volume of the gas inside the can were to **increase or expand**.

In summary, Charles's law states that as the temperature of a gas **increases** its volume will **increase**. This is an example of a direct relationship.

The word pressure is mentioned many times here but what does pressure mean? **Pressure** is defined as how much force is exerted on something per unit of area.

$P = F/A$, P = pressure, F = force, and A = area. The metric unit for pressure is called a Pascal. One pascal = a force of one Newton per square meter. Since this is a very small amount of pressure most pressures are given in kilopascals (kPA) instead.