ChemistryGod

Real-life Examples of Charles's Law

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Physical Chemistry

Charles's law is a gas law relates volume to temperature. The law is named after Jacques Charles, who was a French inventor and scientist. He found through his experiment the volume of a gas increases linearly with an increase in the temperature. Although the discovery of the law goes back to the late 1700s, we can see its applications and examples in our everyday activities. Here are some real-life examples of the law.

Hot air balloon

An air balloon is a classic example of Charles's law. In fact, Charles himself was a balloonist and was one of the few who flew the first hydrogen balloon at the Champ de Mars in Paris.

A hot air balloon

The working principle of an air balloon is simple. It consists of a bag or an envelope, a basket to carry passengers, and a fuel source like propane. On ignition of the fuel, the air inside the envelope heats up. This hot air expands as per Charles's law. As the temperature of the air increases, the volume of the air also increases and consequently, the density decreases. This makes the envelope lighter than the atmospheric air surrounding it. The buoyant force pushes the lighter envelope up in the air, and it flies.

Human lungs

The human lungs are spongy air-filled organs play an important role in respiration. Air flows in when the lungs expand and flows out when they contract.

The human lungs

In winters, the temperature of air decreases. As a consequent, the temperature of the air inside the body also decreases. According to Charles's law states volume is directly proportional to temperature. Hence, the volume of the air decreases with the temperature. It shrinks the lungs and physical activities like jogging becomes difficult in freezing winter days.

Pool floats

As a toddler, we all have used a pool float during swimming lessons. Pool floats are filled with air that makes them much less dense than water.

Pool floats in a swimming pool

When water is cooler than air. The air in swim floats shrinks because of a decrease in temperature of the air inside floats. The reverse phenomenon is observed during hot summer days when water is much warmer. In a hot climate, The temperature of the air inside swim floats increases, and they get overinflated.

Ping-pong balls

Ping-pong or table tennis is an international sport famous in China, Austria, Belarus, Germany, and Hong Kong, to name but a few.

A ping-pong ball with rackets

A common problem with ping-pong balls is they can get a dent when expose to a strong blow or pressure. A common method to fix this dented ball is to immerse the ball into warm water. On immersion, the temperature of the air inside the ball increases, and as per Charles's law, the air expands. The ball is inflated and dents are fixed.

Tyres

Tyres of untouched vehicles get deflated during freezing winter days while get inflated in hot summer days. This unusual behaviour is because of Charles's law. In winter due to low temperatures, the air inside a tyre gets cooler, and they shrink. While in hot days, the air expands with temperature.

Seasonal expansion and contraction of tyres

Helium balloon

Like tyres, helium balloons also experience expansion and contraction with change in surrounding temperature. If you take a balloon out in a

snowy day, it crumbles. When the same balloon is brought back to a warm room, it regains its original shape.

A helium balloon shrinks in a cold environment.

Baking

We can see Charles's law in our kitchens also. Our delicious bakery products like bread, cakes would not be spongy and soft without yeast. Yeast is a leavening agent belonging to fungi. It converts sugars in the dough to carbon dioxide gas. When bread and cakes are baked, this conversion is accelerated. The gas liberating expands because of high temperatures in the oven. Ans this expansion gives bread and cakes spongy appearance.

Bread and a knife

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