

# Matter

## Section 6: Behaviors of Liquids & Gases

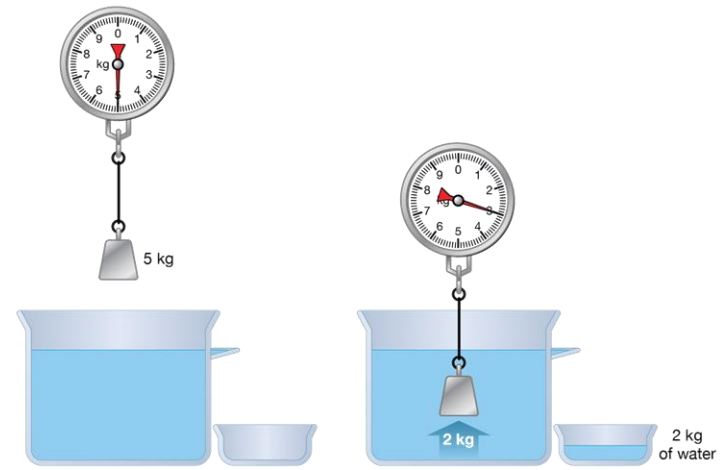
When you place an object in water, it will either float or sink. Where the object ends up depends on the weight and buoyant force exerted on it. **Buoyancy** is the ability of a fluid, or any gas or liquid that flows, to exert an upward force on an object immersed in it. This is called the **buoyant force**. Buoyancy and pressure are related in that the pressure increases with depth.

When scientists began studying gases, they found that all gases behaved similarly when certain conditions were changed. A Greek mathematician named Archimedes discovered that the buoyant force on an object in a fluid is equal to the weight of fluid that is displaced by the object. So, if the fluid is equal to the weight of the object, then it floats. If the buoyant force of the fluid is less than the weight of the object, then the object will sink. A boat displaces enough water to equal the weight of the boat; therefore, it floats. This became known as **Archimedes principle**.

When you are underwater, you can feel the pressure, or the force that is exerted, of the water around you. A French scientist named Blaise Pascal developed **Pascal's principle**, which states that the pressure applied to a fluid is transmitted unchanged throughout the fluid. This can be seen in the squeezing of the end of a tube of toothpaste. The pressure was transmitted through the fluid toothpaste when squeezed.

Swiss scientist Daniel Bernoulli studied the properties of moving fluids through air and water. He observed a relationship between the velocity of a fluid and pressure. **Bernoulli's principle** states that as the velocity of a fluid increases, the pressure exerted by the fluid decreases. This is evident in the design of an airplane wing.

Archimedes' principle

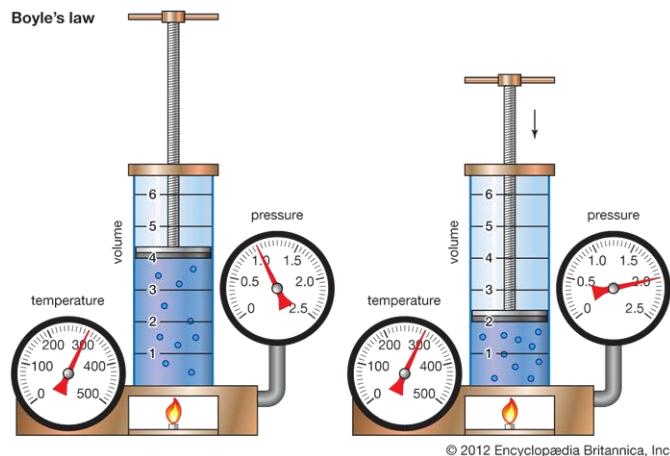


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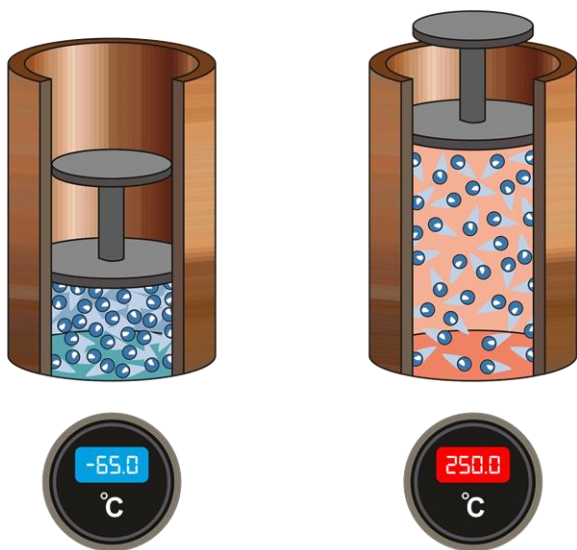
## Section 6: Behaviors of Liquids & Gases continued

British scientist Robert Boyle examined the property of gases and developed **Boyle's law**. This law states that as the volume of gas decreases, the pressure increases, provided the temperature does not change. It also states that as the volume of a gas increases, the pressure decreases. The **pressure-temperature relationship** states that as temperature increases, the pressure increases, provided the volume does not change. For example, when your tire pressure is low in your car, it is usually due to a drop in temperature. When the temperature rises, so does the tire pressure.



### Charles's Law

It is an experimental gas law that describes how gases tend to expand when heated, when the pressure is held constant.



Jacques Charles was also a scientist who observed the properties of gases. **Charles's law** states that as the temperature increases, the volume increases, provided the pressure remains constant. This can be seen in a hot air balloon. A hot air balloon rises because as the air inside is heated, the molecules gain energy and move farther apart, which increases the volume of air inside the balloon.

### Review:

1. What is buoyancy?
2. Explain Bernoulli's principle.
3. Explain the pressure-temperature relationship.