

Objective 4 Fluids

Investigate and identify properties of fluids including density, viscosity and buoyancy

Density refers to the amount of matter in a given volume

Density equation $D = m / V$. Amount of mass per volume. Common units for density are g/cm^3 or g/mL

Fluids have different densities because their molecules have greater mass and/or molecules of the fluid even if they have similar mass are more closely compact. In general if the temperature of a fluid increases the molecules have more kinetic energy and spread out resulting in a larger volume. The larger volume result in a smaller density

••increase temperature decreases the density.

Buoyancy is the tendency of a less dense substance to float in a more dense liquid.

Buoyancy increases as the density of the floating object decreases and/or the density of the liquid increases.

It is much easier to lift a submerged boulder from the bottom of a riverbed to the top of the water than to lift it out of the water. This is because the water lifts up on the block with a force known as the buoyant force. The denser a solution is, the greater its buoyant force is. Archimedes principle states that the buoyant force is equal to the weight of the fluid that is being displaced. For example suppose you have a boulder with a weight of 500 lbs. as measured on a scale. If you took that boulder and placed it in some water until it was completely submerged, it would weigh less by an amount equal to the weight of the water that it just displaced. So if the weight of the water that was displaced was 150 lbs., the boulder would then weigh $500 - 150 = 350$ lbs. Fluids with a greater density have a greater mass for the same volume, therefore when these fluids are displaced they provide a greater buoyant force.

Viscosity: The resistance to flow is known as the viscosity of a substance. Heinz ketchup has a greater viscosity than milk. Temperature will affect a fluid's viscosity. The higher the temperature, the less viscous a fluid becomes. Warm pancake syrup flows much more quickly than cold syrup.

Bernoulli's Principle - The pressure in a moving stream of fluid is less than the pressure in the surrounding fluid. In other words, the faster a fluid moves, the less pressure it exerts.

Jumbo jets and stay in the air because of Bernoulli's Principle

definition	Vocabulary word
machine that takes advantage of the fact that pressure is transmitted equally in all directions in a liquid	hydraulic devices
force that acts over a certain area	pressure
upward force in a fluid that exists because the pressure of a fluid varies with depth	buoyant force
explanation that the pressure in a moving stream of fluid is less than the pressure in the surrounding fluid	Bernoulli's principle
measurement of how much mass is contained in a given volume of an object; mass per unit volume	density
explanation that says that the buoyant force on an object is equal to the weight of the fluid displaced by the object	Archimedes' Principle