Physics - States of Matter

Properties of Fluids

A ***fluid*** will flow but has no definite shape

Liquids and gasses are both fluids

When subjected to ***pressure***, gasses will compress (change volume), but liquids will not.

Pressure: $P = F/A$ scalar quantity recorded in units of the pascal, Pa

Typical Pressures	
Location	Pressure (Pa)
Center of the Sun	3×10^{16}
Center of Earth	4×10^{11}
Deepest ocean trench	1.1×10^{8}
Standard atmosphere	1.013×10^{5}
Air pressure on top of Mt. Everest	3×10^{4}
Our best vacuum	1×10^{-13}

You should know the atmospheric pressure, more common as 101.3 kPa

Examples of Pressure

An object measures 7.5 cm x 12.0 cm x 32.4 cm. The object has a density of 2.40 g/cm^3.

What is the mass of the object?

What is the weight of the object?

What is the pressure on the table as it rests on its smallest face?

What is the pressure of the table on the object?

The Gas Laws

Boyles Law

Charles Law

Combined Gas Law

Example: A helium balloon has a volume of 0.015 m^3 at a pressure of 106.4 kPa and temperature of 20.0 °C. After the balloon is released and rises in the atmosphere to an altitude where the pressure is 65.8 kPa it has a volume of 0.021 m^3. What is the temperature of the air at this elevation?

Ideal Gas Law

For an ideal gas, the pressure time the volume is equal to the number of moles multiplied by the constant R and the temperature in Kelvins.

$$PV = nRT$$

The constant R has a value of 8.31 $Pa \cdot m^3/mole \cdot K$

Example: The average molar mass of the components if air (mainly diatomic oxygen and diatomic nitrogen) is about 29 g/mol. What is the volume of a 2.0 kg of air at one standard atmosphere and 20.0 °C?

Thermal Expansion

An increase in kinetic energy causes an increase in repulsion of molecules.

Materials expand with temperature (generally)

- Decrease in density
- Convection currents
- Linear expansion