

Gas Laws and the Kinetic Theory of Gases

Pressure - Volume (constant mass and temperature)

Consider a volume V of gas at a pressure p . If the volume of the container is reduced without a change in temperature, the particles of the gas will hit the walls of the container more often (but not any harder as their average kinetic energy has not changed). This will produce a larger force on the container walls. The area of the container walls will also reduce with reduced volume. As volume decreases, then the force increases and area decreases resulting in, from the definition of pressure, an increase in pressure i.e. volume decreases hence pressure increases and vice versa.

Pressure - Temperature (constant mass and volume)

Consider a gas at a pressure p and temperature T . If the temperature of the gas is increased, the kinetic energy and hence speed of the particles of the gas increases. The particles collide with the container walls more violently and more often. This will produce a larger force on the container walls. As temperature increases, then the force increases resulting in, from the definition of pressure, an increase in pressure,

i.e. temperature increases hence pressure increases and vice versa.

Volume - Temperature (constant mass and pressure)

Consider a volume V of gas at a temperature T . If the temperature of the gas is increased, the kinetic energy and hence speed of the particles of the gas increases. If the volume was to remain constant, an increase in pressure would result as explained above. If the pressure is to remain constant, then the volume of the gas must increase to increase the area of the container walls that the increased force is acting on, i.e. volume decreases hence pressure increases and vice versa.

