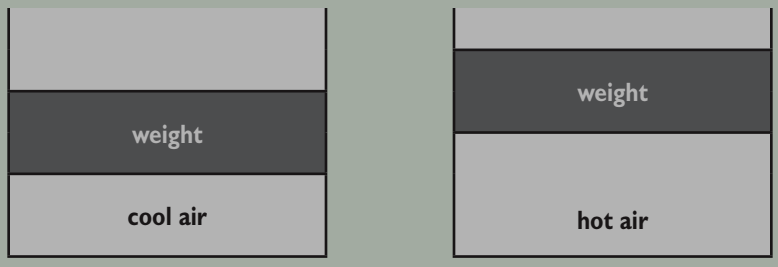
Imagine particles of gas inside a box with a moveable weighted cover, as shown in the diagram. The pressure of the gas is equal to the weight of the cover. What would happen if someone put the box in an oven?



- The temperature of the container and the gas inside would increase.
- The velocity of the particles of the gas and the kinetic energy would increase.
- The particles would be hitting the walls and cover with more force and more often. The pressure of the gas would increase.

If the pressure of the gas were to increase, the weight would move up until the pressure of the gas once again equaled the weight of the cover.

You can now compare the situation with the cold air and the hot air. The pressure is the same and is equal to the weight of the cover. The cool air requires a small volume and the hot air requires a large volume.

Charles's Law can be used to determine how much the volume changes as a result of a change in temperature. If the old volume is divided by the old temperature, it will equal the new volume divided by the new temperature. This is one mathematical way of expressing a direct proportion.

$$\frac{V_{old}}{T_{old}} = \frac{V_{new}}{T_{new}}$$

For example, a balloon has a volume of 240.0 mL at the beach where the atmospheric pressure is 760 torr and the absolute temperature is 298 K. The pressures on the inside and outside of the balloon are equal, so the gas pressure is also 760 torr. When the Sun came out in the afternoon, the volume of the balloon increased to 245 mL.

What was the temperature in the afternoon? The atmospheric pressure was still 760.0 torr.

$$\frac{240.0\ \text{mL}}{298\ \text{K}} = \frac{245\ \text{mL}}{T_{new}}$$

Solving for T_{new} gives a temperature of 304 K.