Introduction to Vacuum

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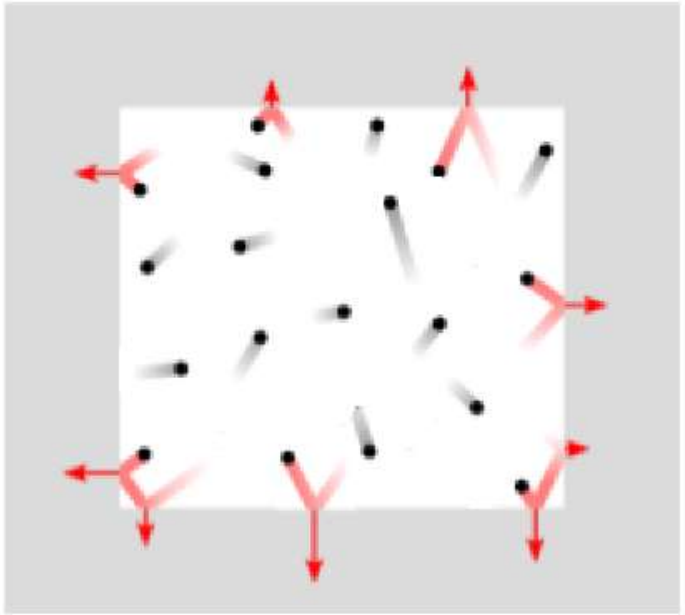
What is a Vacuum?

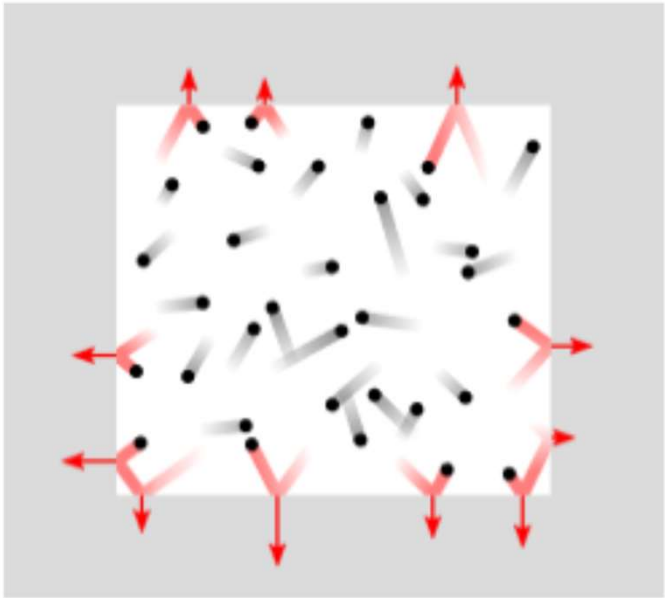
The standard definition of vacuum is “the state of a gas at which its pressure in a vessel and therefore its particle density is lower than that of the ambient surrounding atmosphere or in which the pressure of the gas is lower than 300 mbar, i. e. lower than the pressure of the atmosphere on the Earth’s surface.“



What is Pressure?

Pressure can be defined as the force per unit area exerted on a surface, the walls of a chamber for example, by particle collisions.

More particles in the container result in a higher number of collisions with the chamber walls, resulting in a higher force applied to the walls and hence a higher pressure.

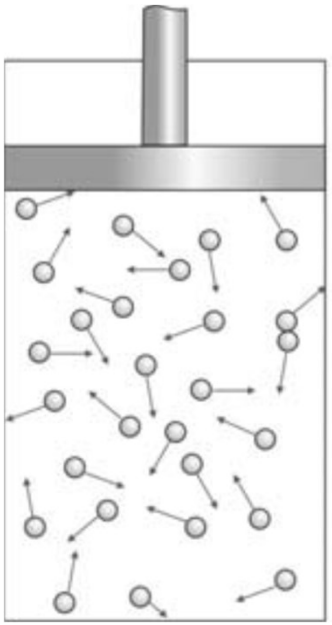


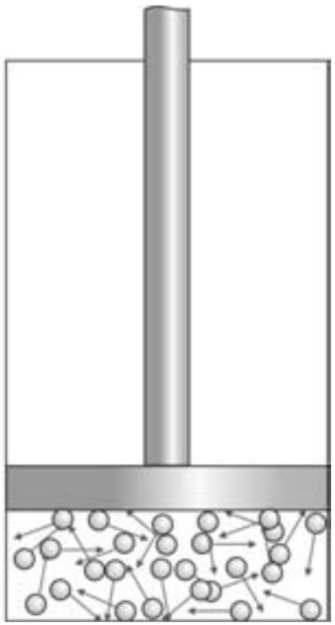
Pressure and Volume

Consider a trapped volume of gas in a jar with a plunger attached:

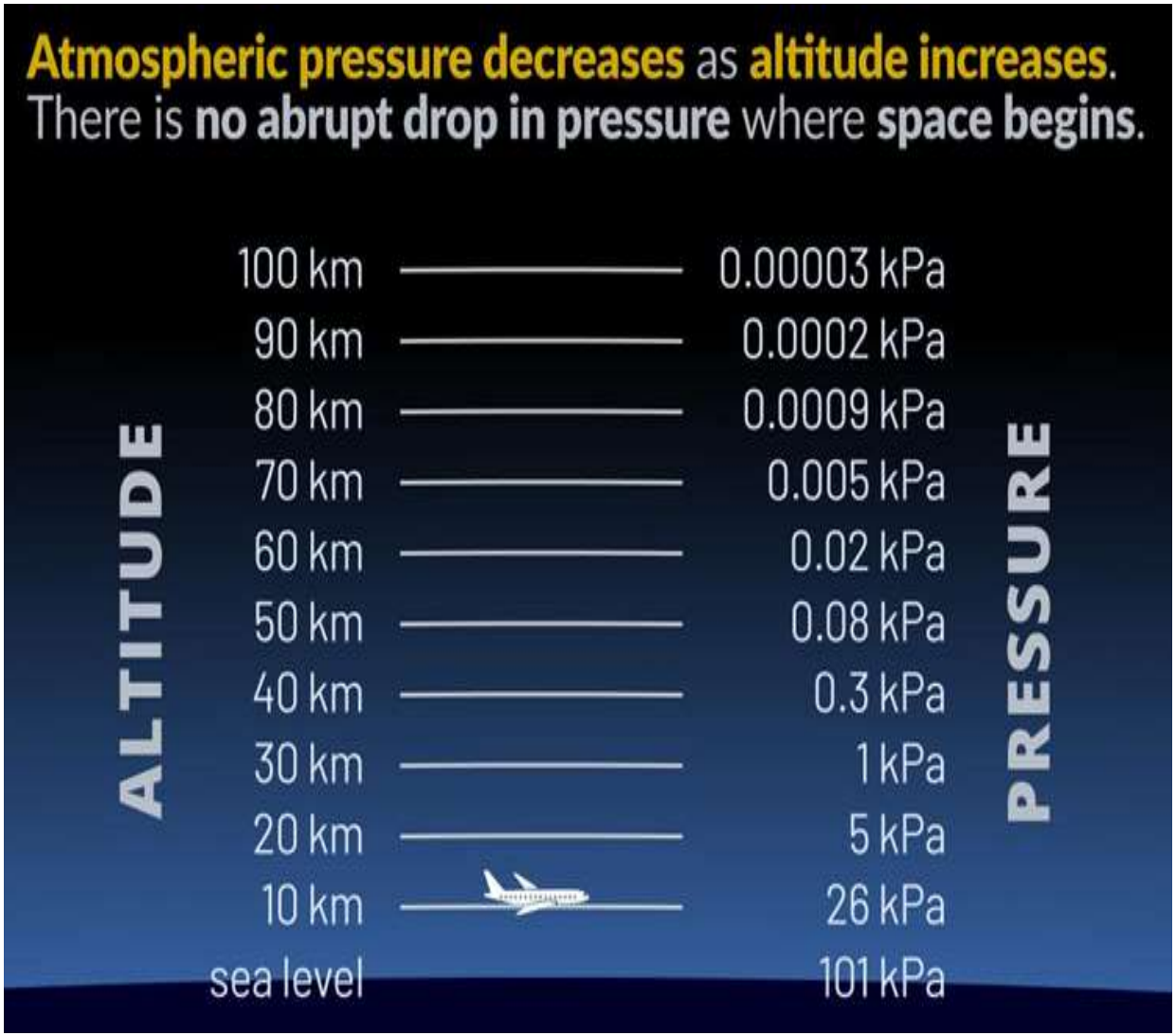
Low pressure means relatively low collisions

Higher pressure means less volume to occupy and more collisions



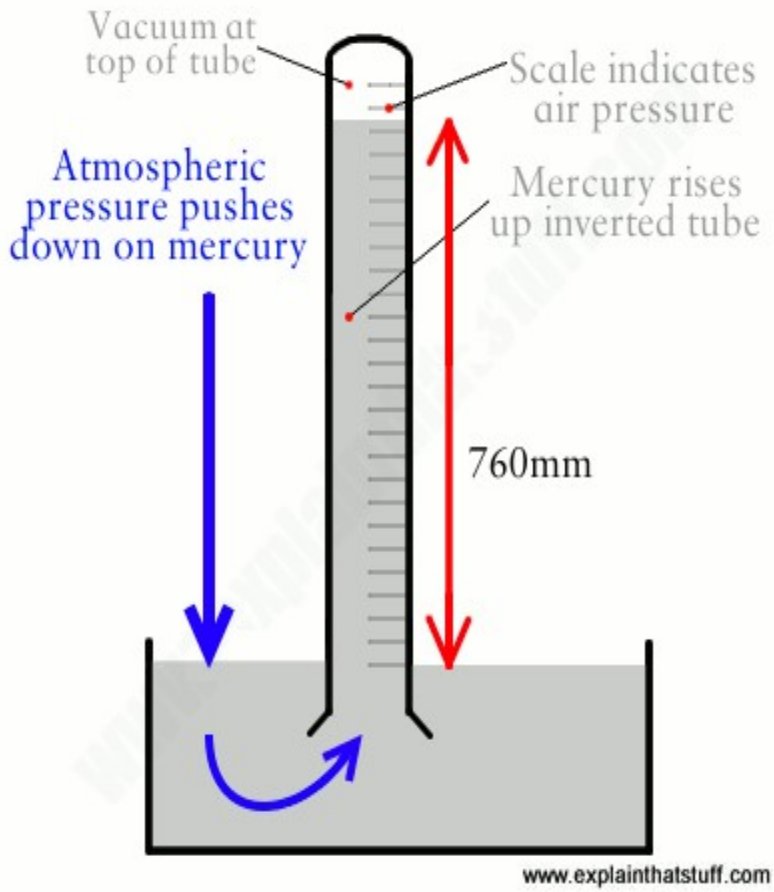


Atmospheric Pressure



Pressure, Temperature & Volume

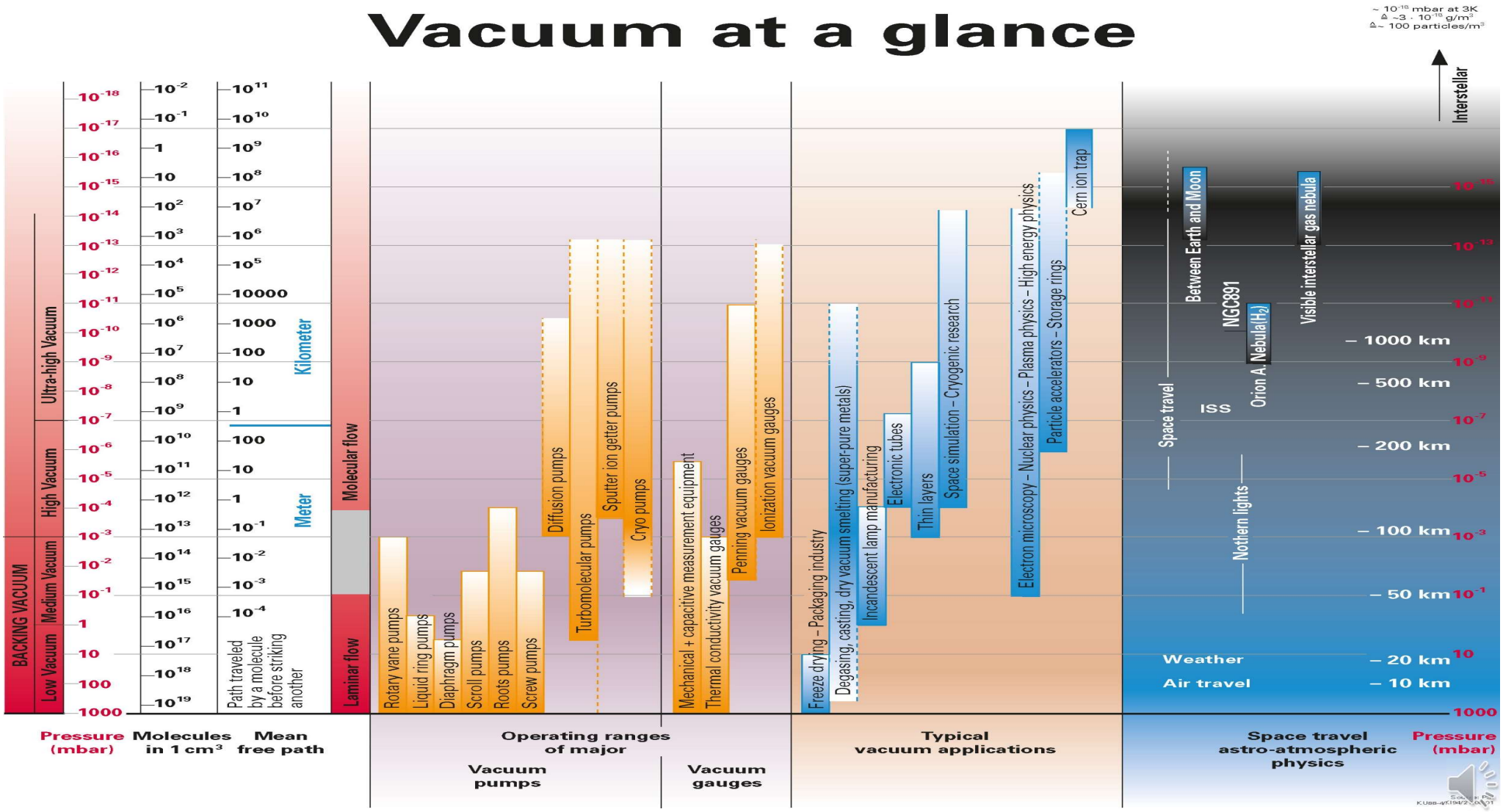
- Atmosphere pushes down on the mercury
- The higher the pressure the more the mercury rises
- The lower the pressure the less the mercury moves.



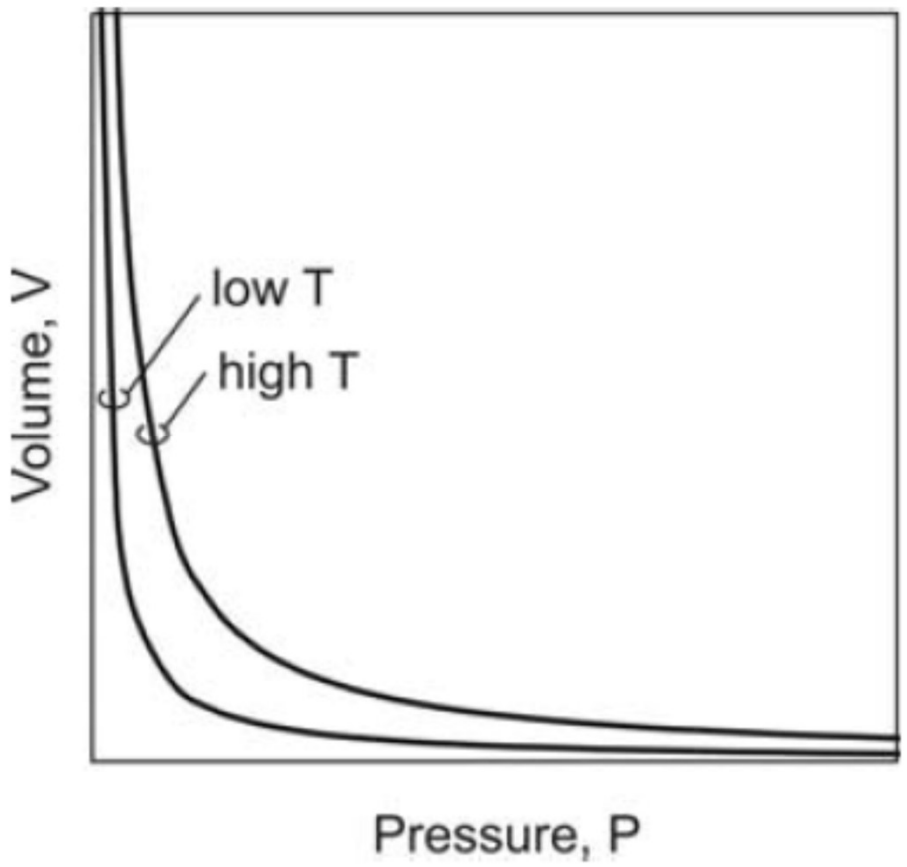
Units of Measurement

	Pa	bar	hPa	µbar	Torr	micron	atm	psi
Pa	1	$1 \cdot 10^{-5}$	$1 \cdot 10^{-2}$	10	$7.5 \cdot 10^{-3}$	7.5	$9.87 \cdot 10^{-6}$	$1.45 \cdot 10^{-4}$
bar	$1 \cdot 10^{5}$	1	$1 \cdot 10^{3}$	$1 \cdot 10^{6}$	750	$7.5 \cdot 10^{5}$	0.987	14.5
hPa	100	$1 \cdot 10^{-3}$	1	1,000	0.75	750	$9.87 \cdot 10^{-4}$	$1.45 \cdot 10^{-2}$
µbar	0.1	$1 \cdot 10^{-6}$	$1 \cdot 10^{-3}$	1	$7.5 \cdot 10^{-4}$	0.75	$9.87 \cdot 10^{-7}$	$1.45 \cdot 10^{-5}$
Torr	$1.33 \cdot 10^{2}$	$1.33 \cdot 10^{-3}$	1.33	1,330	1	1,000	$1.32 \cdot 10^{-3}$	$1.93 \cdot 10^{-2}$
micron	0.133	$1.33 \cdot 10^{-6}$	$1.33 \cdot 10^{-3}$	1.33	$1 \cdot 10^{-3}$	1	$1.32 \cdot 10^{-6}$	$1.93 \cdot 10^{-5}$
atm	$1.01 \cdot 10^{5}$	1.013	1,013	$1.01 \cdot 10^{6}$	760	$7.6 \cdot 10^{5}$	1	14.7
psi	$6.89 \cdot 10^{3}$	$6.89 \cdot 10^{-2}$	68.9	$6.89 \cdot 10^{4}$	51.71	$5.17 \cdot 10^{4}$	$6.8 \cdot 10^{-2}$	1

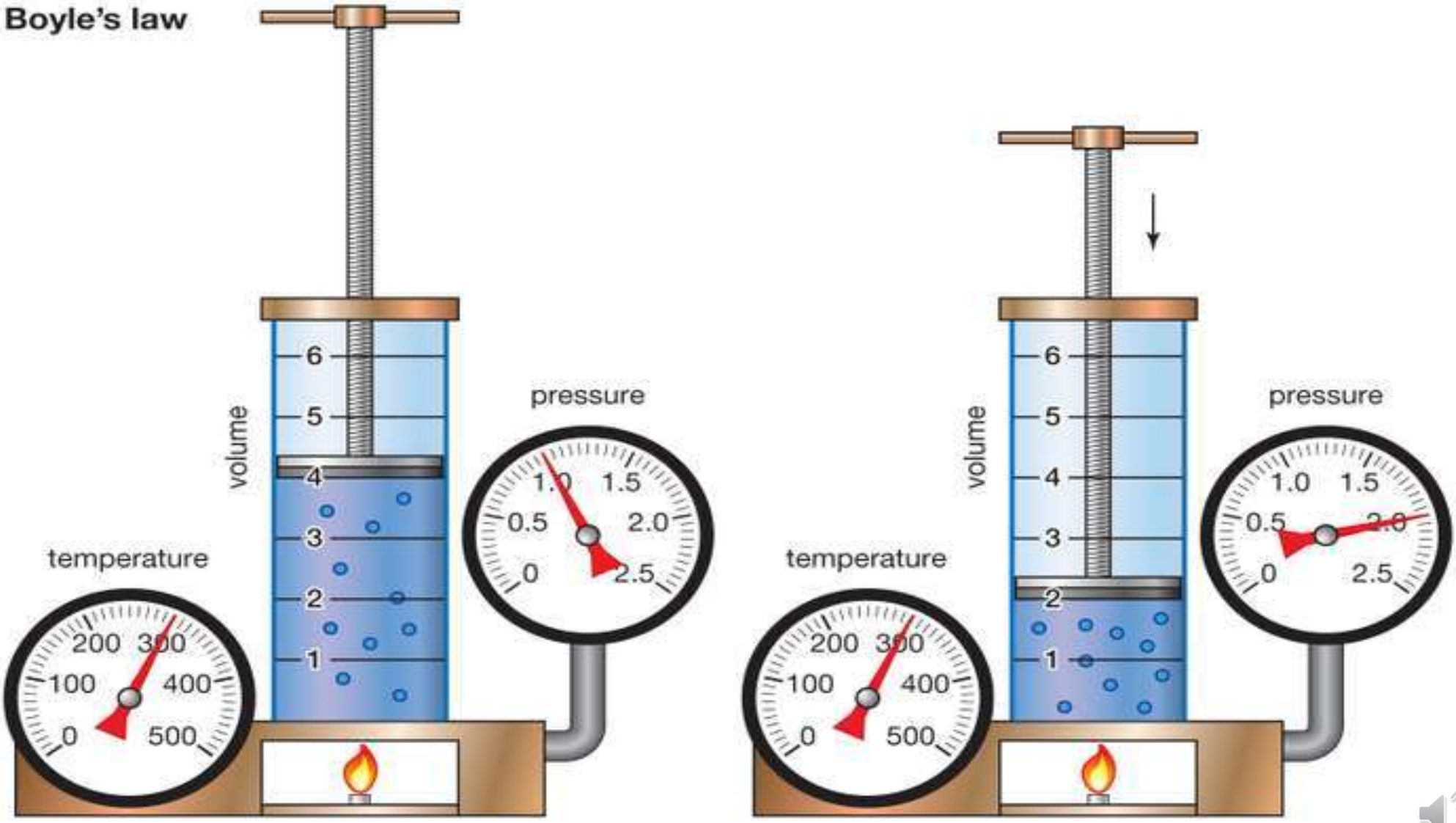
Vacuum at a glance



Pressure, Temperature & Volume



Boyle's law



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Thank You For Watching ☺

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