Temperature

Temperature is a measure of the average kinetic energy of the molecules.

$$T = \frac{3}{2k_B} K \qquad T = \frac{3}{2k_B} (1/2\ mv^2)$$

T is temperature measured in Kelvin - the absolute temperature scale.

K is kinetic energy $K=1/2\ mv^2$

k_B is called the Boltzmann's constant = 1.380658×10^{-23} J/K

Temperature

- The faster the molecules move the more space they occupy.
- Consider a parallel examples of people in the halls or cars on the highway.
- The more crowded it gets the slower they must move.
- To move faster there must be more space.
- Molecules follow the same principle.

Temperature

- The thermometer is a tool invented to measure temperature.
- The particular temperature scale is chosen to conveniently represent the amount of kinetic energy.

	°F	°C	K
Freezing Saturated Ice Water	0	-17.8	255.37
Human Body Temp	100 (98.6)	37	310.15
Freezing Pure Water	32	0	273.15
Boiling Pure Water at 1 atmosphere	212	100	373.15
Absolute Zero	-459.67	-273.15	0

Temperature

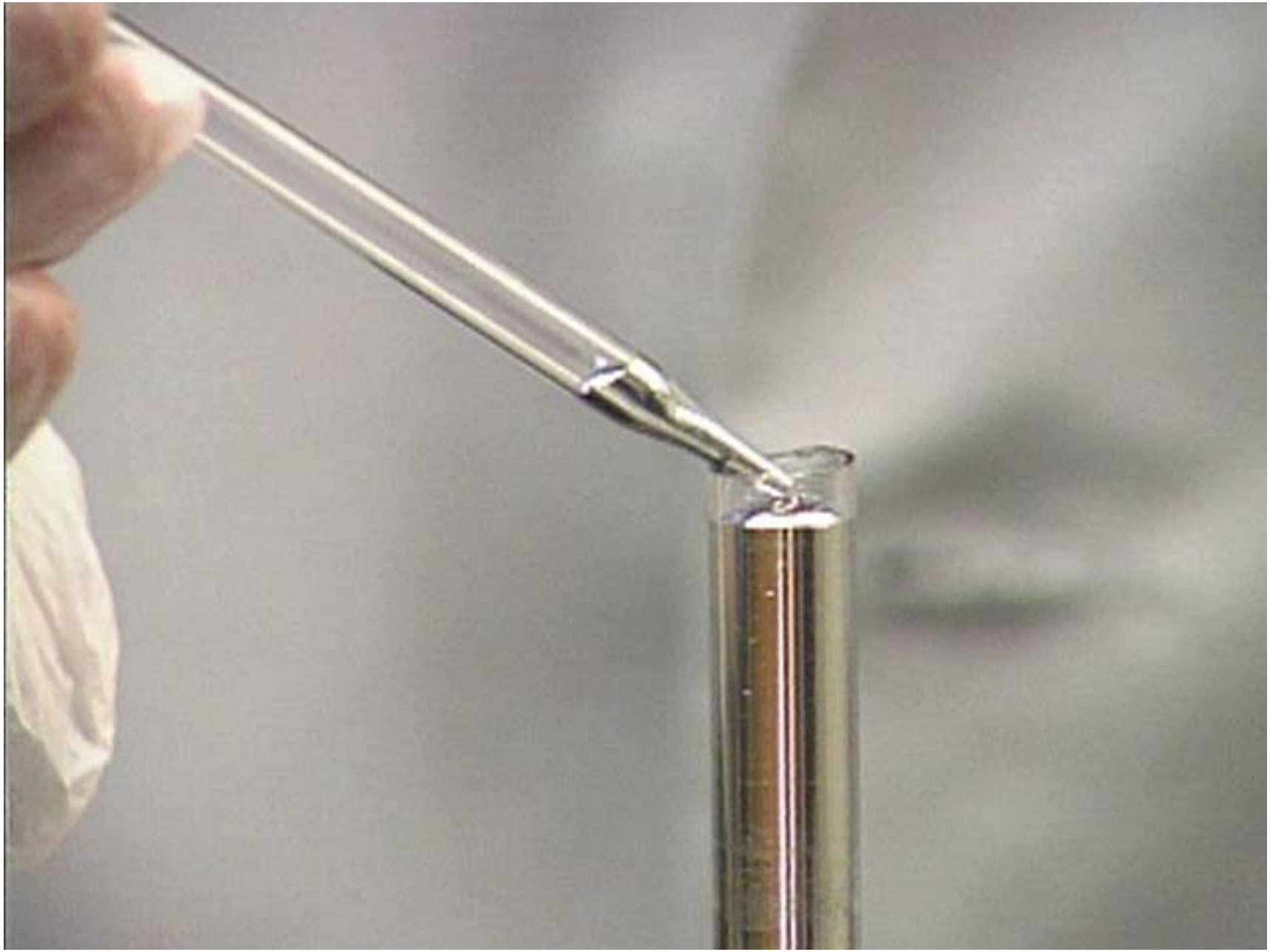
- Because temperature is a measure of the average kinetic energy of molecules there is a minimum possible temperature.
- Molecules cannot move slower than not moving at all (in more technical terms they would have 0 degrees of freedom).
- This minimum temperature is called absolute zero and corresponds to zero on the Kelvin temperature scale.

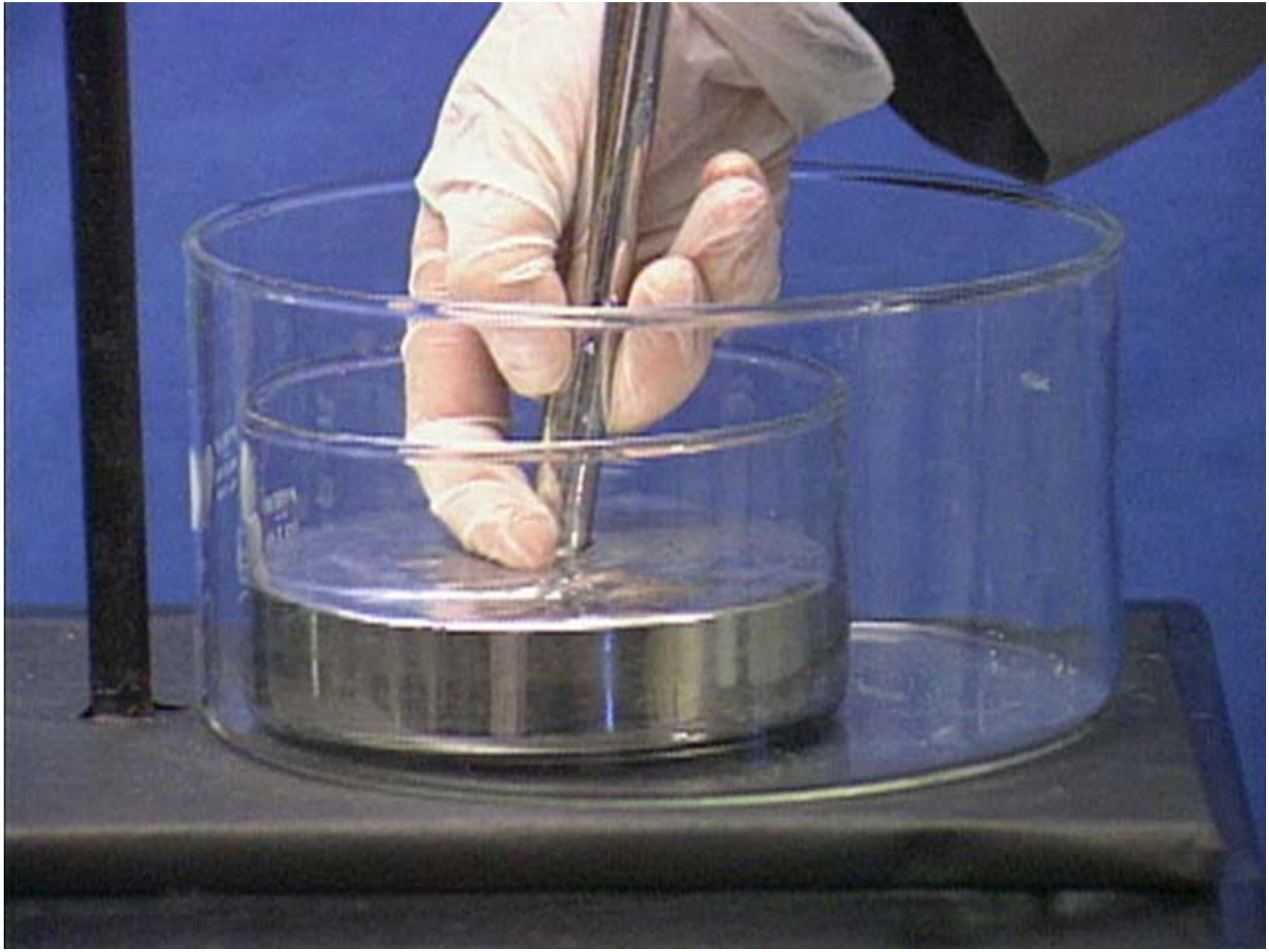
Pressure

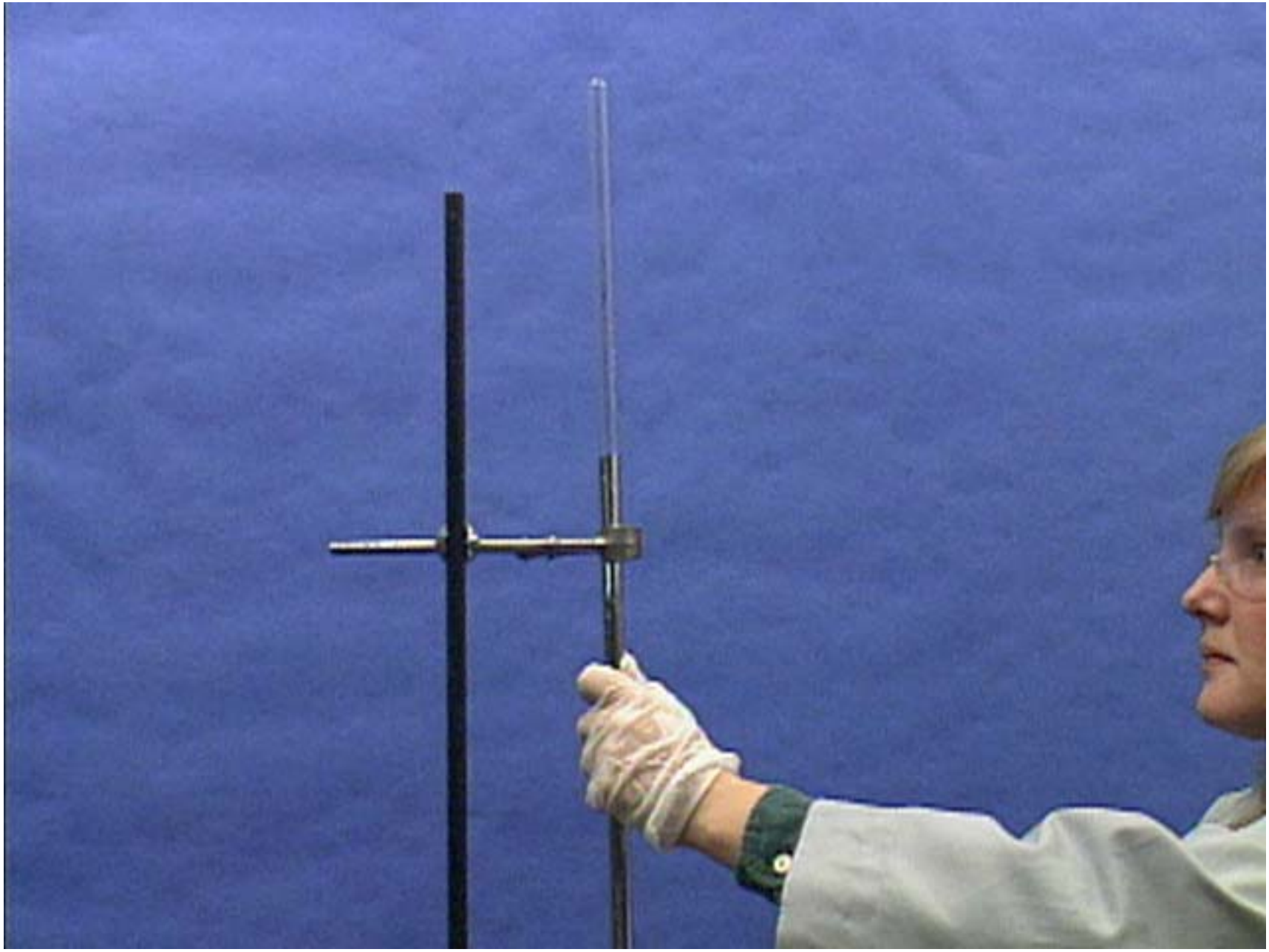
- Pressure is force/unit area.
- Pressure is the result of moles of molecules hitting each other and their container.
- Force is measured in newtons (N).
- Area is measured in meters squared (m^2)
- One N/m^2 is called a Pascal (Pa)
- Other metric units of pressure are kilopascals (kPa), atmosphere, mm of Hg, torr and bar

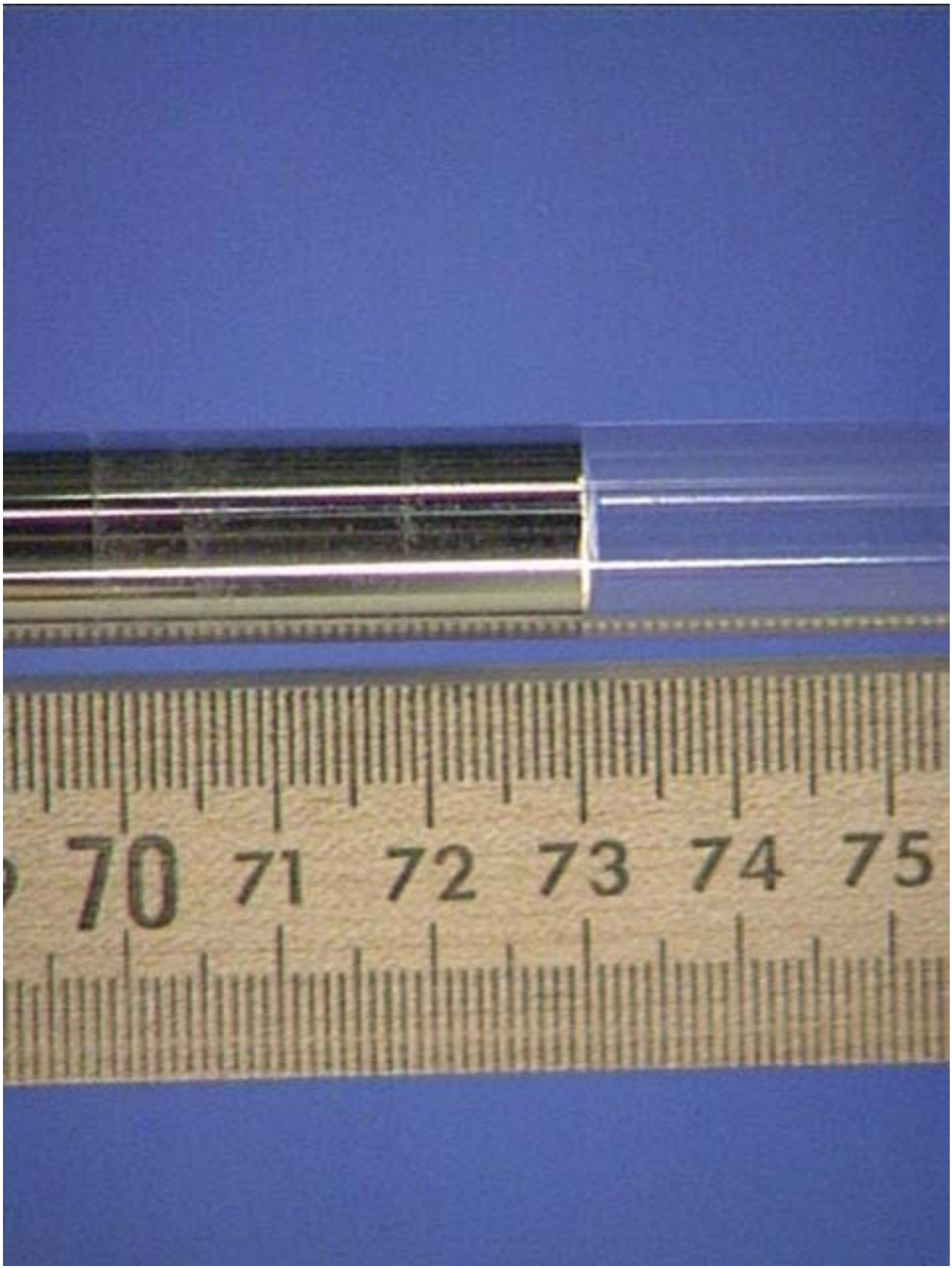
Pressure

- Pressure was first measured by an Italian physicist named Evangelista Torricelli, the inventor of the barometer.
- The pressure unit of torr is named in his honor. 1 torr = 1 mm of Hg





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Barometer

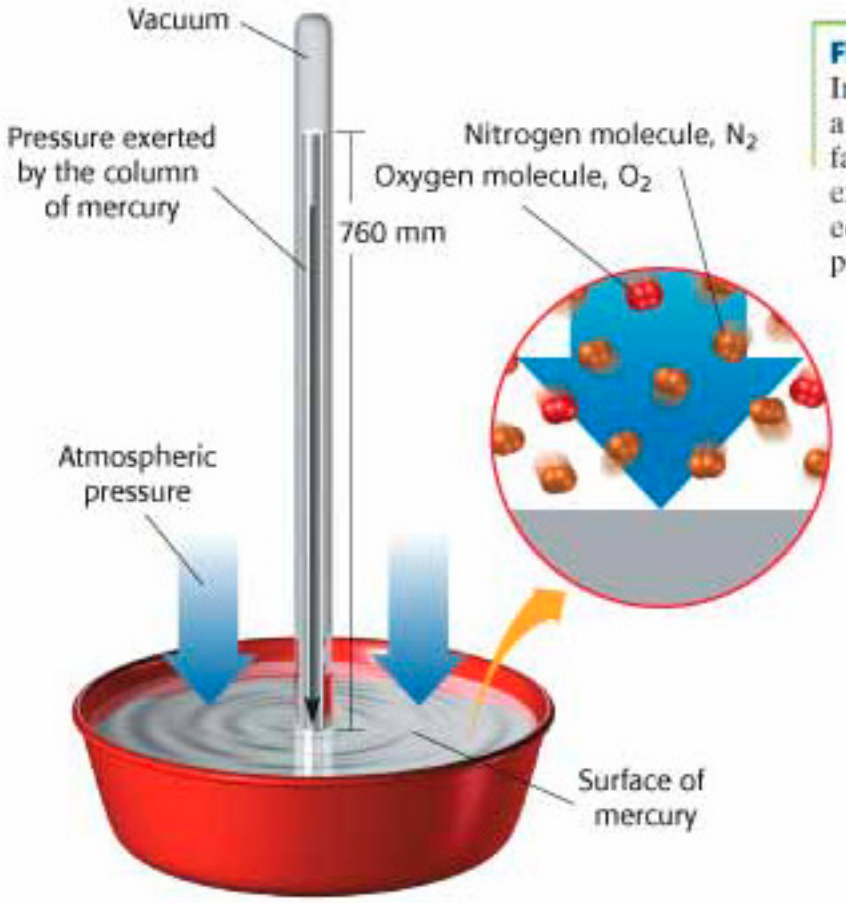

Figure 6
In the sealed column of a barometer, the mercury falls until the pressure exerted by its weight equals the atmospheric pressure.

Barometer

Mercury (Hg) is used because it is a liquid with a very high density (1 mm Hg = 13.6 mm H_2O).

- It does not evaporate very well at atmospheric temperatures and does not freeze until -38.9°C.