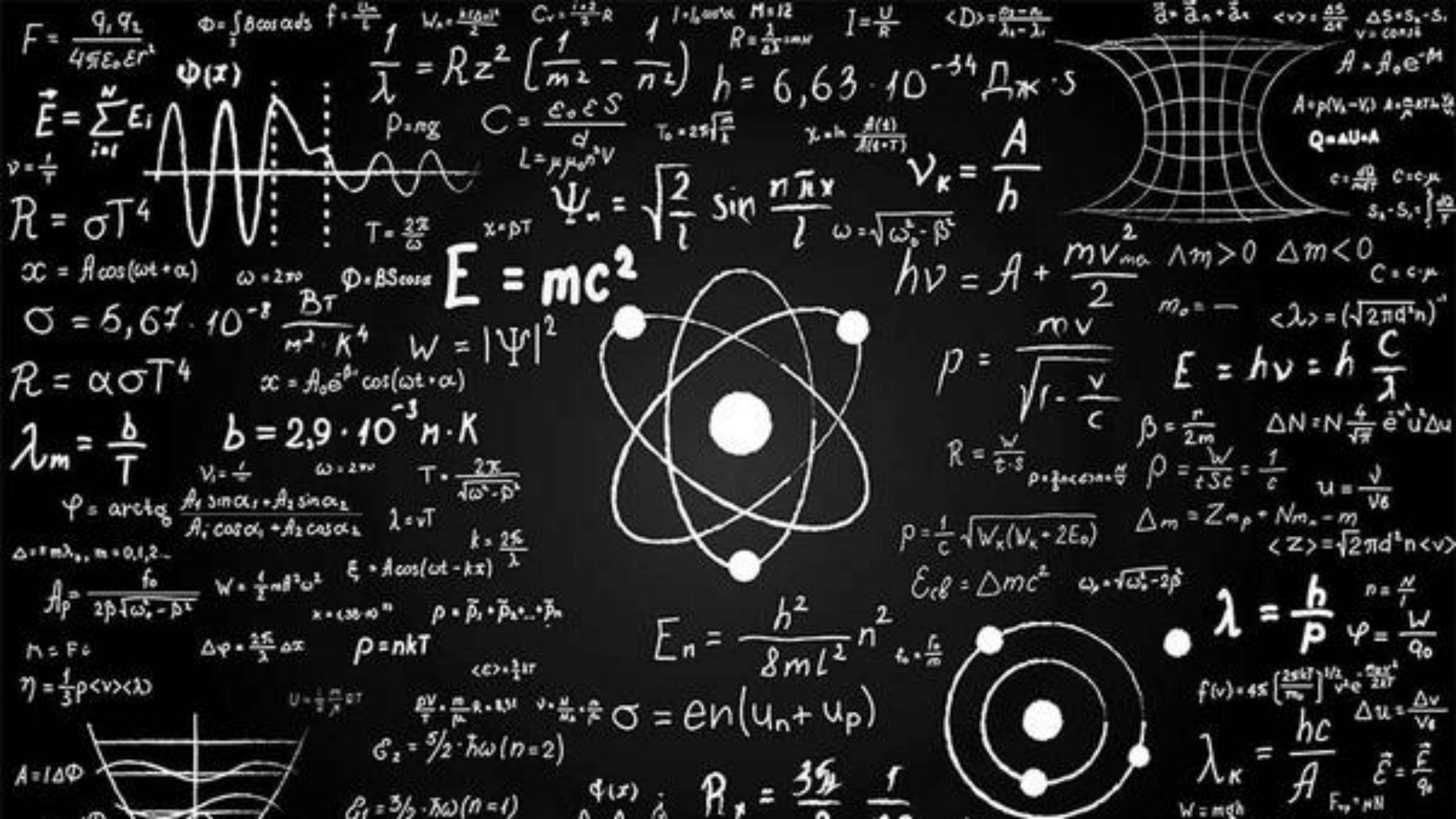
COURSE TITLE	**:**	**PHYSICAL CHEMISTRY I**
COURSE CODE	**:**	**15U5CRCHE07**
UNIT 1	**:**	**GASEOUS STATE**

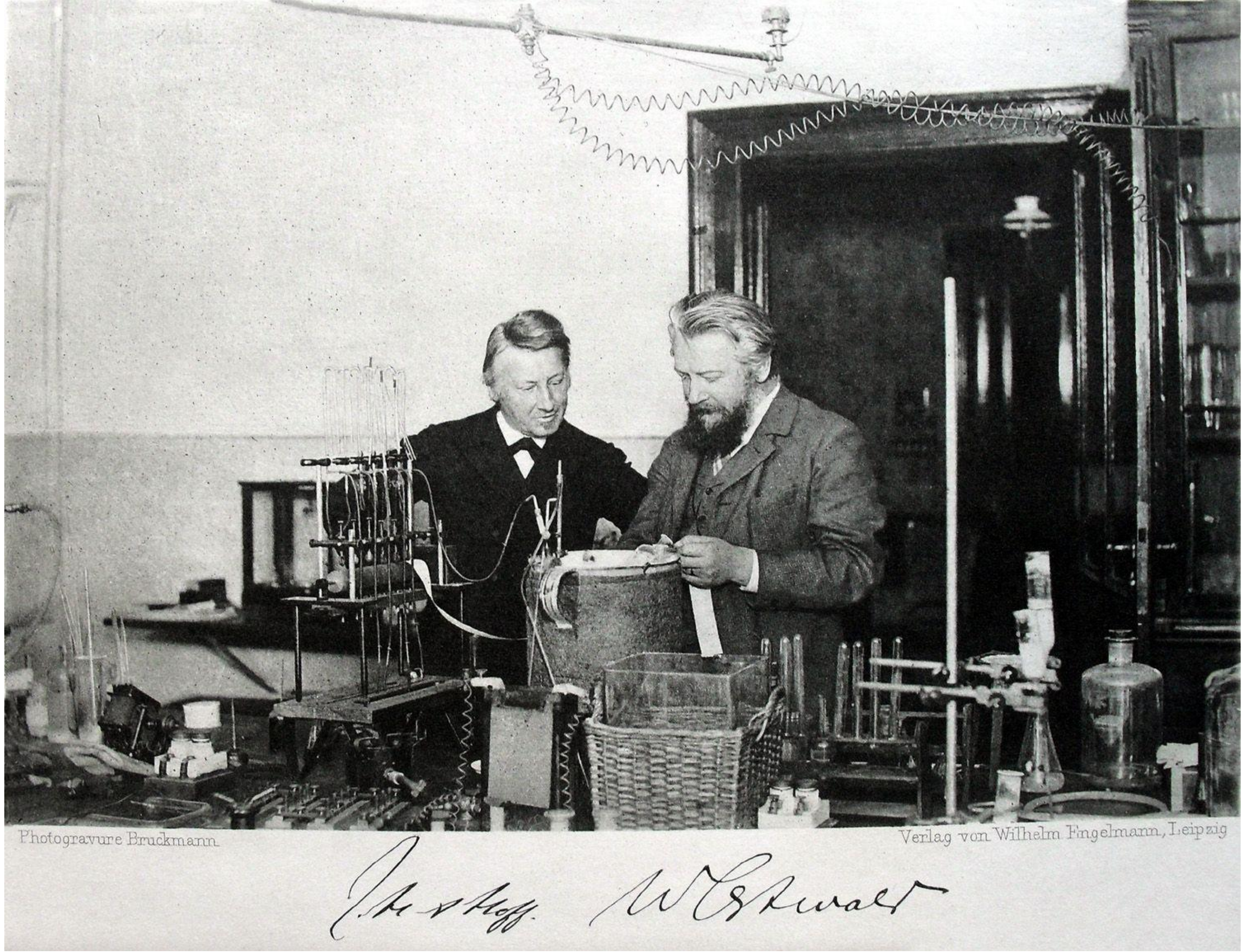
SESSION 1	**:**	**Introduction to Gaseous State**



E = mc²
h = 6,63 · 10⁻³⁴ Дж · S
R = σT⁴
R = ασT⁴
σ = 5,67 · 10⁻⁸ Вт / м² · K⁴
W = |Ψ|²
λm = b / T
b = 2,9 · 10⁻³ м · K
x = A cos(ωt + α)
νк = A / h
hν = A + mv²ma / 2
E = hν = h c / λ
λ = h / p
En = h² / 8ml² n²
σ = en(un + up)
ρ = nkT
λк = hc / A
C = ε₀εS / d
Φ(x)

PHYSICAL CHEMISTRY

- **Physical chemistry is a branch of Chemistry that study the physical principles governing the properties and behavior of chemical systems.**
- **It deals with the relations between the physical properties of substances and their chemical composition and transformations.**
- **Physical chemistry also explores how '*matter*' behaves on a molecular and atomic level and how chemical reactions occur.**
- **It seeks to measure, correlate and explain the quantitative aspects of chemical processes.**



JACOBUS HENRICUS VAN'T HOFF
Dutch Chemist
Winner Of First Nobel Prize In Chemistry (1901)

WILHELM OSTWALD
German Chemist
Father of Physical Chemistry

***Zeitschrift für physikalische Chemie* ("*Journal of Physical Chemistry*").**

MATTER

Matter is everything that has mass and takes up space by having volume.

All matter is made up of atoms, which are in turn made up of different subatomic particles.

The five phases of matter (or states of matter):

There are four natural states of matter: *Solids, liquids, gases* and *plasma*.

The fifth state is the man-made *Bose-Einstein condensates*.

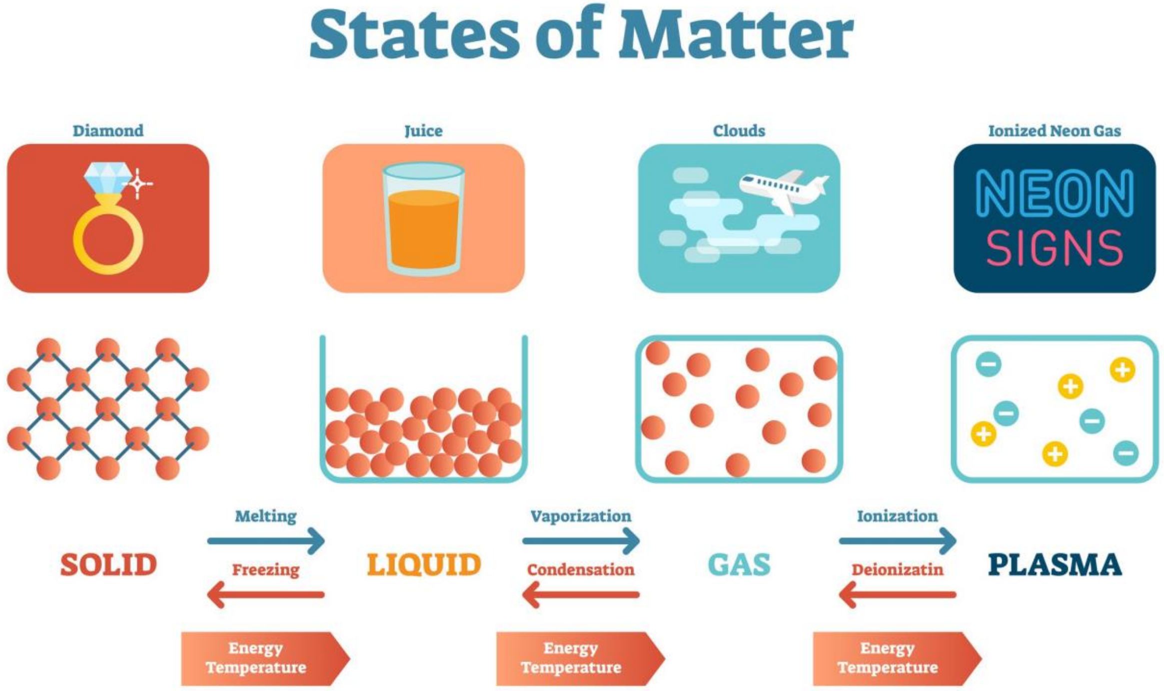
BOSE-EINSTEIN CONDENSATE | SOLIDS | LIQUIDS | GASES | PLASMAS (only for low density ionized gases)

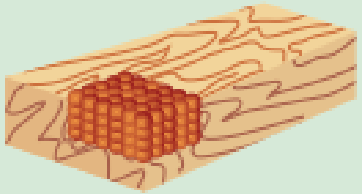
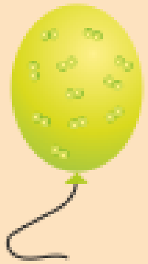




Lower Temperature

Higher Temperature



	Properties	Solids	Liquids	Gases
1	**Mass**	Definite	Definite	Definite
2	**Shape**	Definite	Acquires the shape of the container	Acquires the shape of the container
3	**Volume**	Definite	Definite	Indefinite
4	**Compressibility**	Not possible	Almost Negligible	Highly Compressible
5	**Fluidity**	Not possible	Can flow	Can flow
6	**Rigidity**	Highly rigid	Less rigid	Not rigid
7	**Diffusion**	Slow	Fast	Very fast
8	**Space between particles**	Most closely packed 	Less closely packed 	Least closely packed 
9	**Interparticle force**	strongest	Slightly weaker than in solids	Negligible

PROPERTIES OF GASEOUS STATE:

- Gases are fluids. However unlike liquids the atoms or molecules are far apart and thus there is little interaction between molecules.
- Expand to fill the volume of any container.
- Have much lower densities than solids or liquids.
- Mix with one another readily and thoroughly (i.e. they are miscible).
- Change volume dramatically with changing temperature.
- Collision of gas particles on the container’s walls exerts a pressure.
- Gases are compressible (their volume decreases as the pressure increases).
- The pressure of a gas in a closed container increases as the temperature increases.
- The pressure of a gas in a closed container increases as the number of gas molecules increases.

STATE OF A GASEOUS SYSTEM

State of a system is the condition of a system at a particular instant of time defined by a set of state variables like,

Temperature (T),

Pressure (P),

Volume (V) and

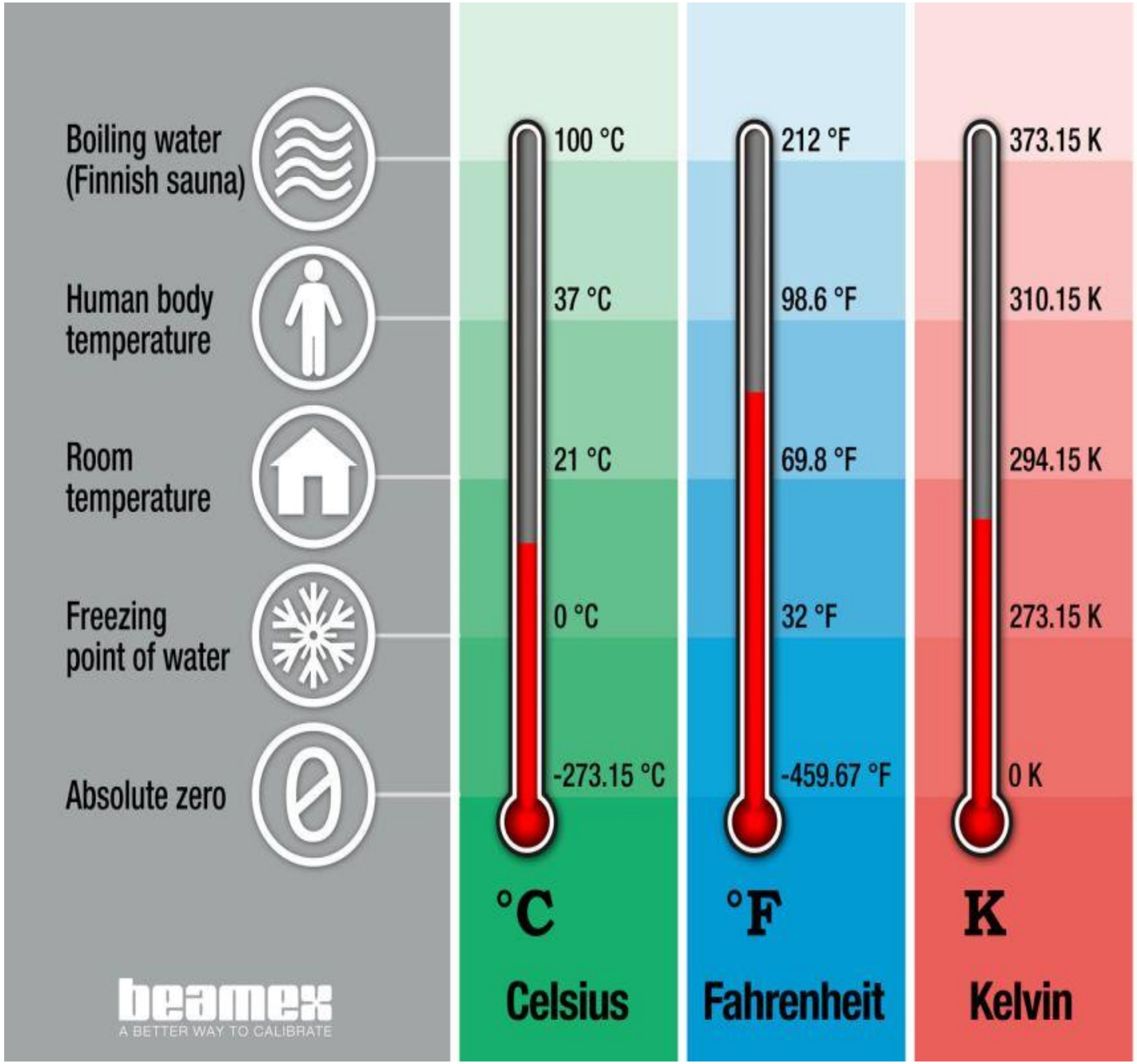
no. of moles of components (n) of the system.

A change in these variables lead to change in the state of the system.

Temperature (T):

	from Celsius	to Celsius
Fahrenheit	[°F] = [°C] × 9⁄5 + 32	[°C] = ([°F] − 32) × 5⁄9
Kelvin	[K] = [°C] + 273.15	[°C] = [K] − 273.15

Celsius to Kelvin	$T_K = T_C + 273$
Kelvin to Celsius	$T_C = T_K - 273$
Celsius to Fahrenheit	$T_F = 1.80T_C + 32$
Fahrenheit to Celsius	$T_C = \frac{T_F - 32}{1.80}$


Boiling water (Finnish sauna)
Human body temperature
Room temperature
Freezing point of water
Absolute zero
100 °C
37 °C
21 °C
0 °C
-273.15 °C
212 °F
98.6 °F
69.8 °F
32 °F
-459.67 °F
373.15 K
310.15 K
294.15 K
273.15 K
0 K
°C
Celsius
°F
Fahrenheit
K
Kelvin
beamex
A BETTER WAY TO CALIBRATE

PRESSURE (P)

Pressure is the force exerted by the gas per unit area of the walls of the Container.

SI unit of pressure is Pascal (Pa), which is defined as the pressure exerted when a force of 1N acts on a 1 m^2 area.

1 ***Pa*** = 1 ***Nm^{-2}***

Other units of pressure are atmosphere (***atm***), ***bar***, ***mm of Hg*** and ***Torr***.

Name	Symbol	Value
pascal	1 Pa	1 N m^{-2}, 1 kg m^{-1} s^{-2}
bar	1 bar	10^5 Pa
atmosphere	1 atm	101.325 kPa
torr	1 Torr	(101 325/760) Pa = 133.32 . . . Pa
millimetres of mercury	1 mmHg	133.322 . . . Pa
pound per square inch	1 psi	6.894 757 . . . kPa

Assignment

Convert 1 atm into all other units of pressure.

VOLUME (V)

Volume of the container is the volume of the gas sample.

Volume is expressed in liter (L), milliliter (mL) or cubic centimeter (cc or cm^3) or cubic metre (m^3)

$$1L = 1000\ mL = 1\ dm^3 = 1000\ cm^3$$

S. I. units are m^3 and C. G. S. units are cm^3

AMOUNT OF THE SUBSTANCE

Amount of gas is measured in gram or kilogram.

1 kg = 10^3 g

The mass of the gas is expressed in number of moles.

Moles of gas (n) = Mass / Molar Mass