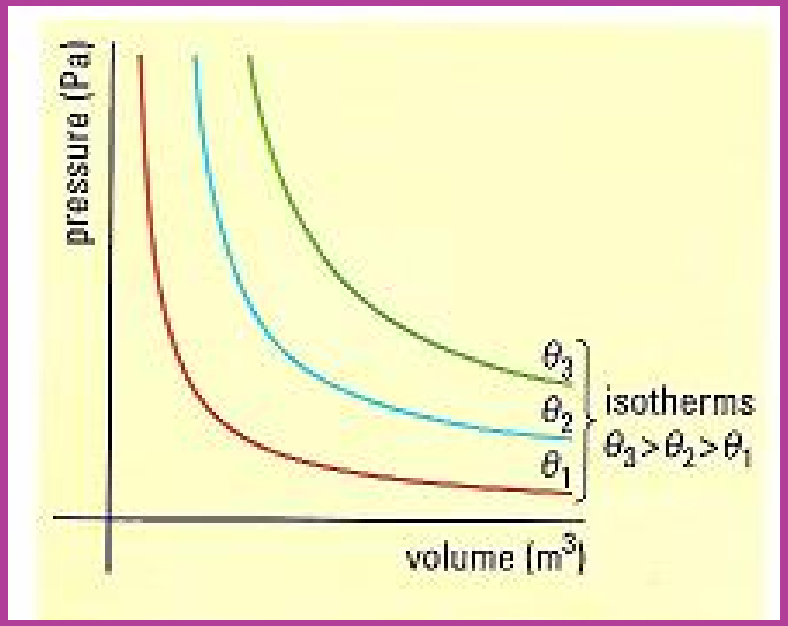
ENERGY OF AN IDEAL GAS IN ISOLATED TANK

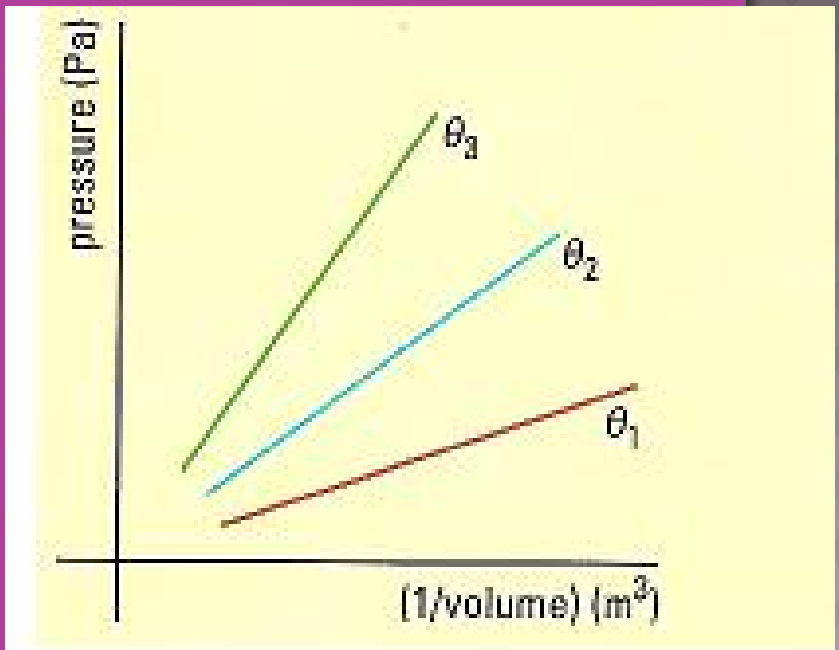
- Internal energy of a gas can be changed by doing work or transfer of thermal energy (using 1-st law of thermodynamics $\Delta U = Q + W$).

- Let´s observe changes by isothermal, isochoric and isobaric process keeping the same mass of a gas.

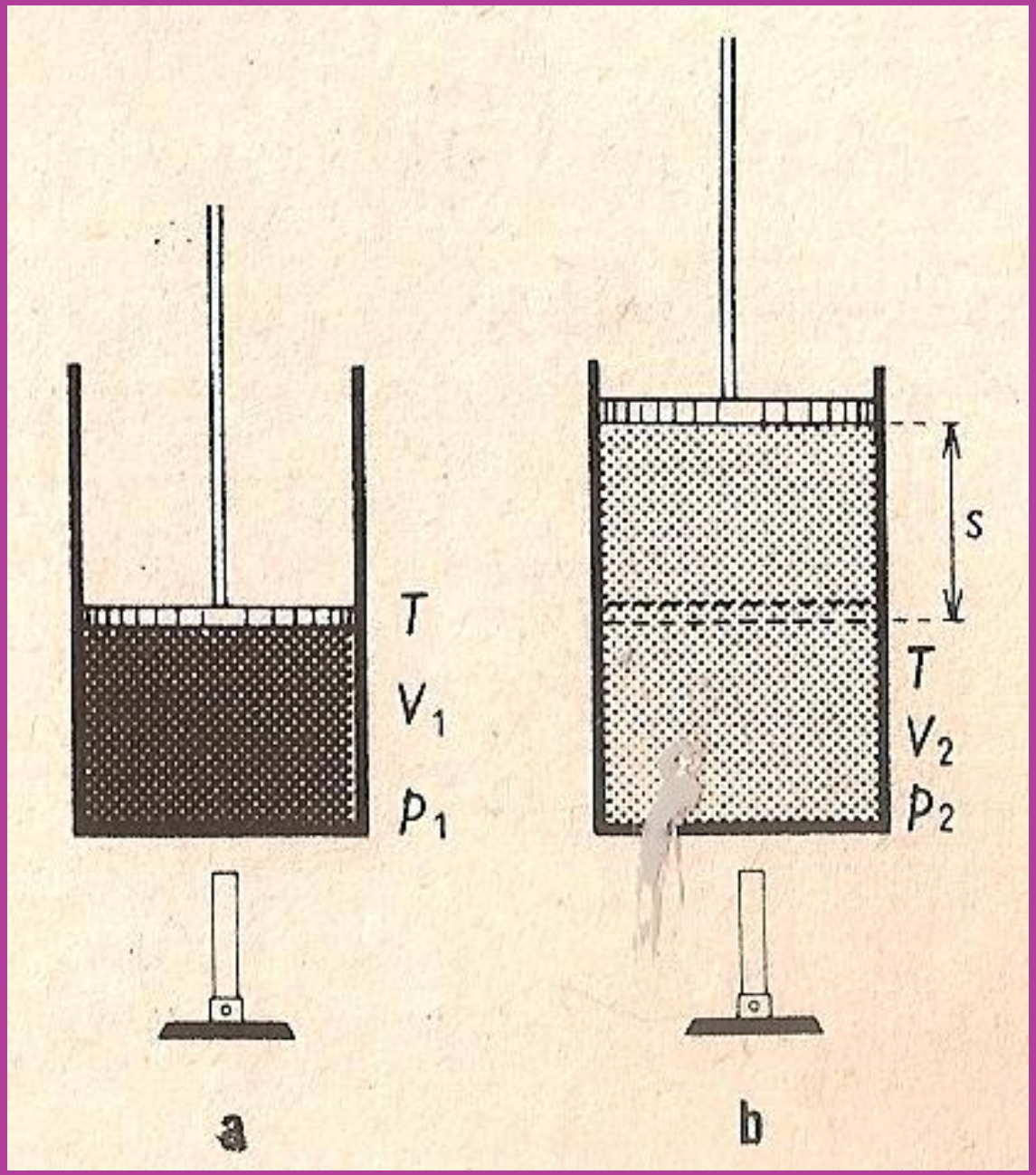
Isothermal change

- T = const.
- Average mean square speed is constant
- $\Delta U = 0J$
- W – work done by the gas expanding the volume
- Thermal energy transfered to the gas is equal to the work done by the gas.
- W = Q
- **p V = constant (Boyle´s law)**



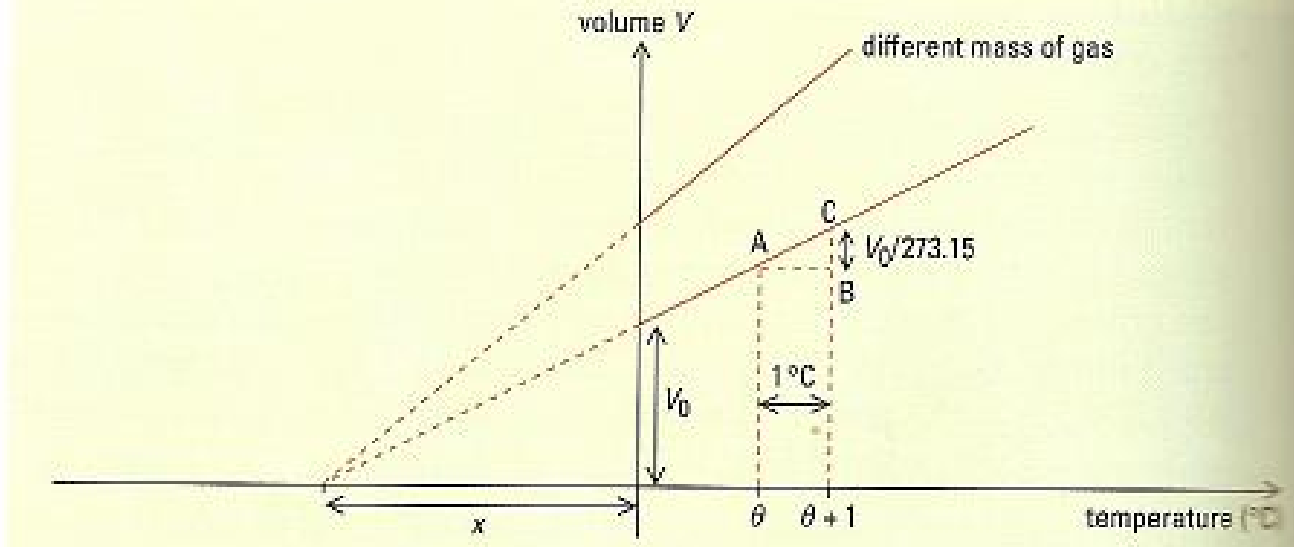


Plotting p against 1/V will give a straight line, showing that Boyle's law is being obeyed.


T
V1
P1
a
s
T
V2
P2
b

Izochoric change:

- V = const, p and T is changed
- Thermal energy transfered to the gas is $Q=mc\Delta T$ (c – specific heat capacity of a gas)
- V is constant, that means gas doesn´t do any work, W = 0J!
- $\Delta U = Q$!
- Thermal energy transfered to the gas by izochoric change is equal to the change of internal energy!
- p / T = const (Charle´s law)



gradient of line from Δ ABC $= \frac{V_0/273.15}{1} = \frac{V_0}{273.15}$

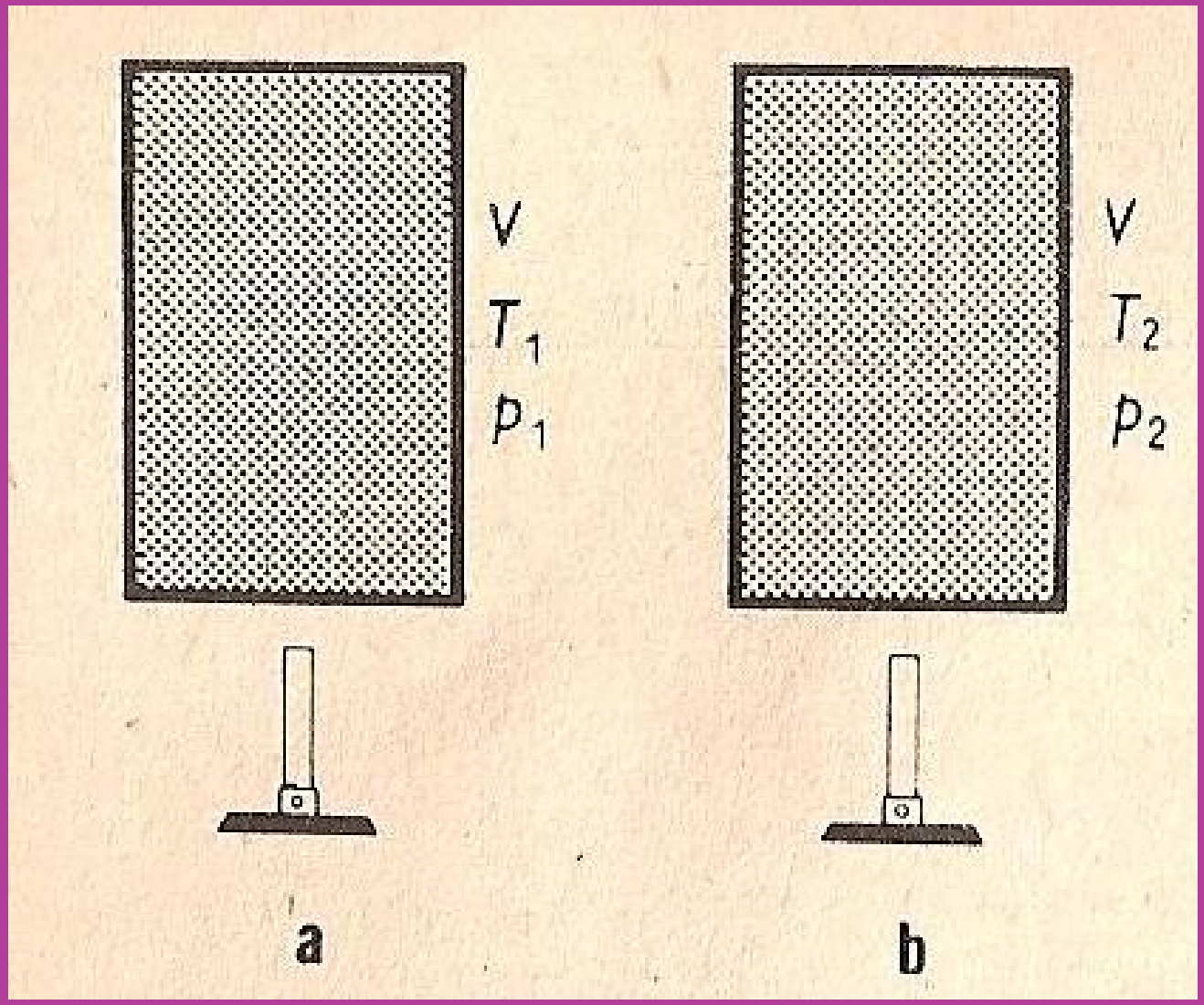
also

gradient of line $= \frac{V_0}{x}$

so

$x = 273.15\,°C$

Using Charles's law.


V
T_1
p_1
V
T_2
p_2
a
b

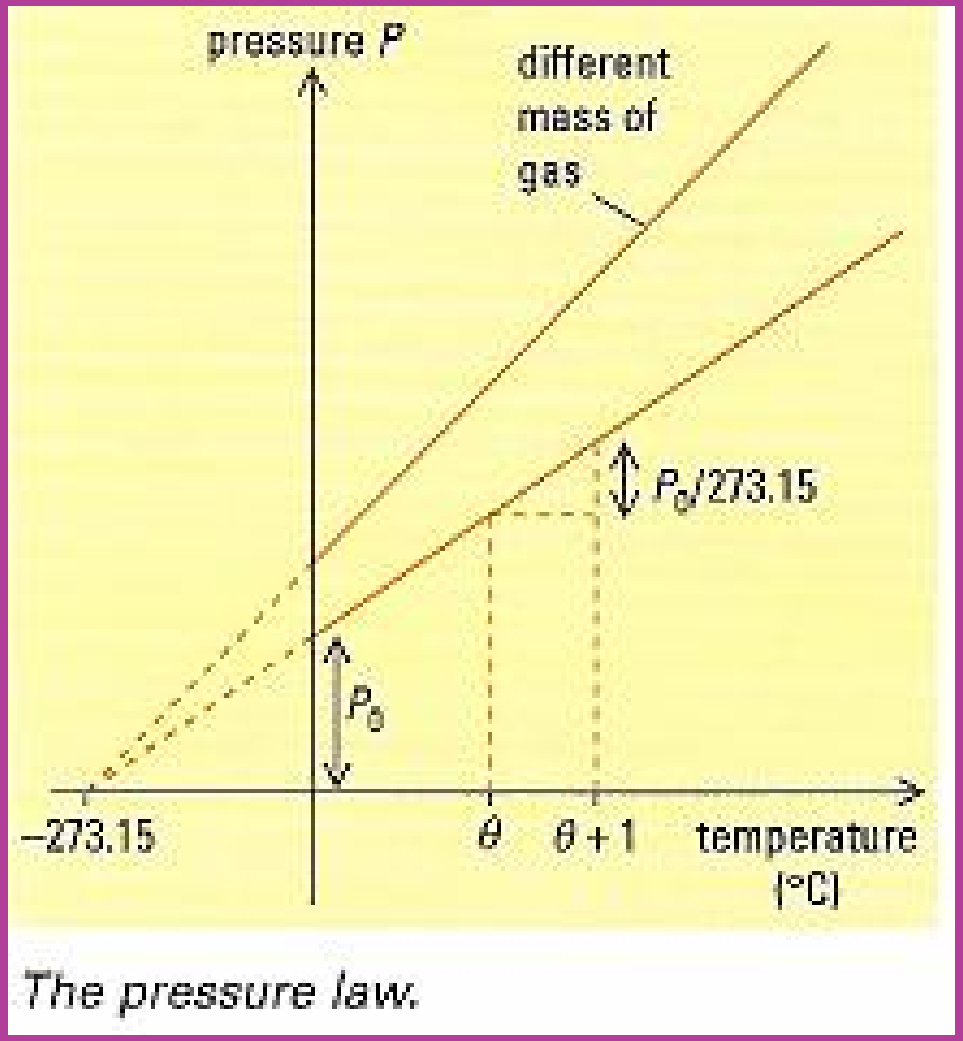
Izobaric change:

- P = const, V and T is changed!
- Thermal energy transferred to the gas is $Q=mc\Delta T$
- The gas expands, V increases – the gas does work:

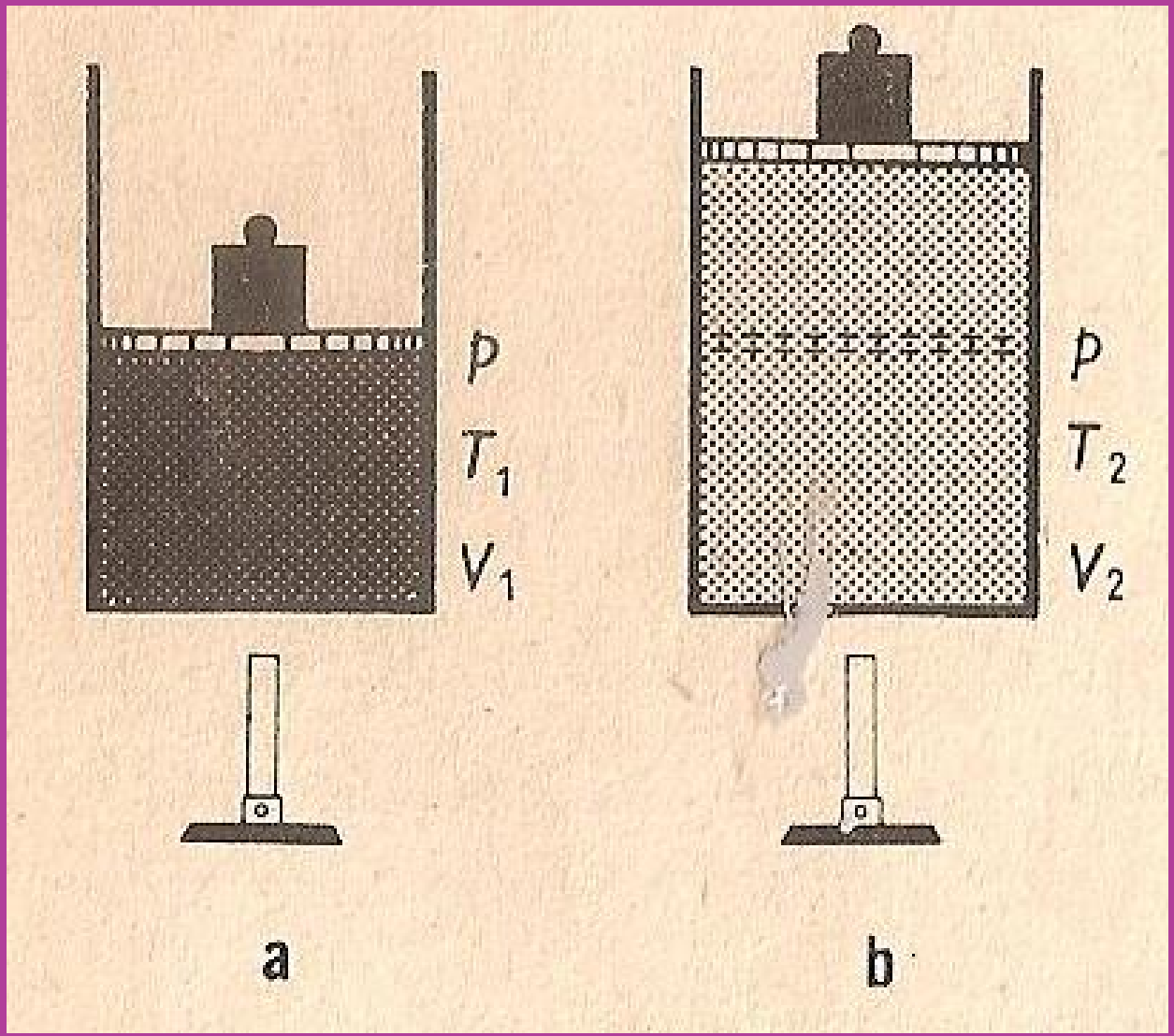
$$Q = \Delta U + W$$

Thermal energy transferred to the gas is equal to the sum of change of internal energy of the gas and work done by the gas.

V / T = constant (Gay – Lussac´s law – tha pressure law)



The pressure law.


p
T1
V1
a
p
T2
V2
b