

الباب الثاني معادلات الحالة

: :

: An intensive variable

:

An extensive variable

:

n

m

»

« specific value

()

ρ

$$v = \frac{V}{m} : v$$

$$\rho = \frac{m}{V} = \frac{1}{V/m} = \frac{1}{v}$$

molal specific

n

. value

:

v

$$v = \frac{V}{n}$$

v

v

$$\frac{V}{n} \quad \frac{V}{m}$$

$$v = \frac{V}{n} = \frac{V}{\frac{m}{M}}$$

n

M

$$v = \frac{V}{m/M} = M \frac{1}{\rho}$$

:

- mole

32 O₂

:

:

:

:

$$F(p, v, T) = 0$$

(ρ) v

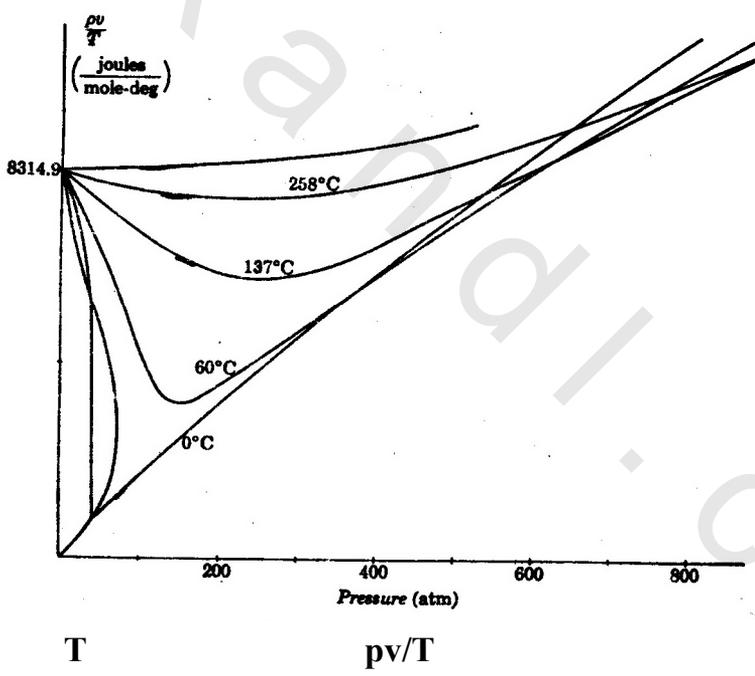
T

P

. Power series

$$v = \frac{V}{n}$$

pv/T . T



$$R = 8.3149 \times 10^3 \text{ \{Joules / Kgm - mol - deg (mks)\}}$$

$$R = 8.3149 \times 10^7 \text{ \{erg/ gm - mol - deg (cgs)\}}$$

$$R = 0.08206 \text{ \{later - atm/gm - mol - deg (Chemist)\}}$$

$$Pv/T = R, \quad pv = RT \quad \text{or} \quad PV = nRT \dots$$

$$pv/T = R$$

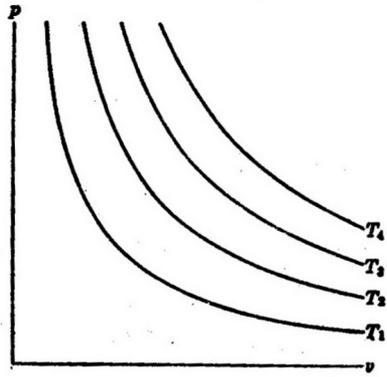
$$pv = RT :$$

$$R = 8.3149 \times 10^3$$

$$P = 1.01320 \times 10^5 \text{ Pa} \quad T = 273.16 \text{ K}$$

$$v = RT/P$$

$$= \frac{8.3149 \times 10^3 \times 273.16}{1.01325 \times 10^5} = 22.4146 \text{ m}^3 / \text{kgm.mol}$$



Boyle's law

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(

:

:

p - v - T relation

empirical

Van der Valls

:

(v - b) :

:

:

$$\left(p + \frac{a}{V^2}\right) = RT$$

b a

:

Substance	$\frac{a}{n\text{-m}^4/(\text{kgm-mole})^2}$	$\frac{B}{\text{m}^3/\text{kgm-mole}}$
He	3.44×10^2	0.0234
H ₂	24.8	0.0266
O ₂	138	0.0318
CO ₂	366	0.0249
H ₂ O	580	0.0319
Hg	292	0.0055

$$p = \frac{RT}{v} - \frac{a}{v^2} + \frac{b}{v^3} - \frac{ab}{v^4} + \dots$$

$$pv = RT \left(1 - \frac{b}{v}\right) - \frac{a}{v}$$

$$\left(1 - \frac{b}{v}\right)^{-1} = 1 + \frac{b}{v} + \frac{b^2}{v^2} + \dots$$

$$Pv = RT + \left(\frac{RTb - a}{v}\right) + \frac{RTb^2}{v^2} + \dots$$

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الأسئلة

10m × 10m × 30m - 1
 . 29

29 -

0.5m² - 2
 . 20°C

- (a)

(b)

(c)

(d)

. 500°C

20°C (e)

15

p₁ - 3

. p = Kv

v p

. T₁ v₁

K

T₁

p₁

K

(a)

. R

p - v

(b)

(c)

. T = 200°K

: () - 4

76

. g = 980.665 cm/sec²

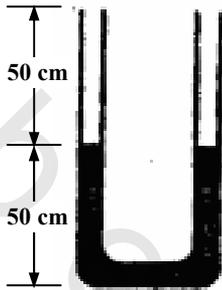
(a)

$g =$

$$\frac{n}{m^2} \quad (b)$$

$$13.6 \text{ gm/cm}^3 \quad 76$$

$$\cdot 980 \text{ cm / sec}^2$$



$$1 \text{ cm}^2 \quad U \quad - 5$$

$$T \quad U \quad 300^\circ\text{K} \quad (a) \quad - 6$$

$$T \quad 300^\circ\text{K} \quad (b)$$

p-v

$$J \quad -$$

h_o

h

$$h_o = 75 \text{ cm}$$

$$h_2 = h_1 = 20 \text{ cm}$$

$$\cdot 200 \text{ cm}$$

$$\text{CO}_2$$

$$\cdot 60^\circ\text{C}$$

$$\dots$$

$$(a)$$

$$0.5 \text{ m}^3$$

(b)

137°C

CO₂

-

:

(a)

(b)

(c)

Joules/Kgm-mole-deg K

pV/T

(d)

-

S

:

m

ml

$$S = m_1/m$$

:

(a)

$$pV = (S + 1) (m/M_2) RT$$

M₂

P

:

V

pV/m

(b)

T(°C)	800	1000	1200
$\frac{pV}{m} \frac{\text{Joules}}{\text{Kgm}}$	3.72×10^4	5.08×10^4	7.30×10^4

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