

الباب الثالث

الشغل

:

$$W = \int F \cos \theta \, ds$$

P_e

dF

$$dF = P_e \, dA : \quad dA$$

dS

$$. P_e \, dA \, dS = dF \, dS = dW :$$

$$dW = P_e A dS :$$

$$dW = P_e dV :$$

$$P_e dV$$

$$dW = p dV :$$

$$d'W$$

$$d'W, dV$$

n m

$$p'w = pdv :$$

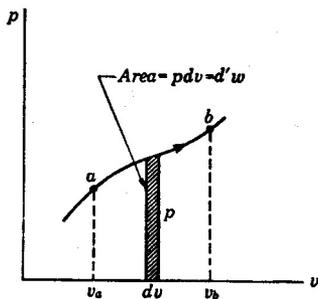
p-v-T

p-v

$$() d'W$$

:

dv



p-v

()

W

:

b

a

$$W = \int_{v_a}^{v_b} p dv$$

. v_b v_a

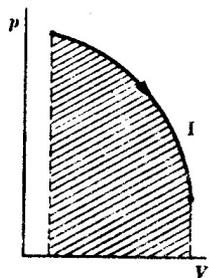
. b

a

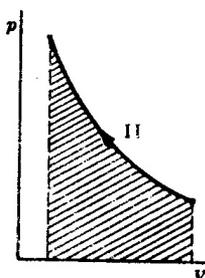
Cyclic processes

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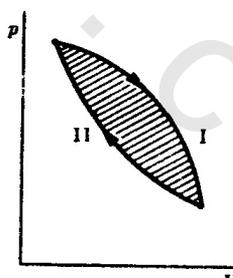
p-v



(a)



(b)



(c)

: (T
T

) W_T

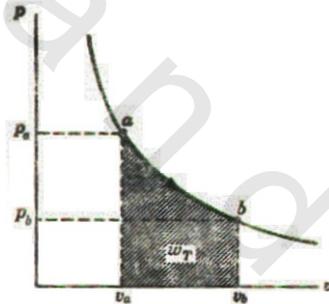
W_T

$$W_T = \int_{v_a}^{v_b} p dv$$

$$pv = RT$$

$$p = \frac{RT}{v}$$

$$W_T = \int_{v_a}^{v_b} \frac{RT}{v} dv = RT \ln \frac{v_b}{v_a}$$



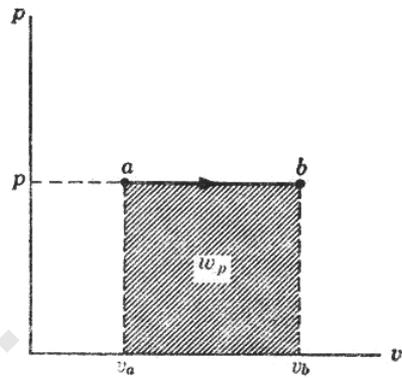
: T

$$p_a v_a = p_b v_b = RT$$

$$W_T = p_a v_a \ln \frac{v_b}{v_a} = RT \ln \frac{p_a}{p_b}$$

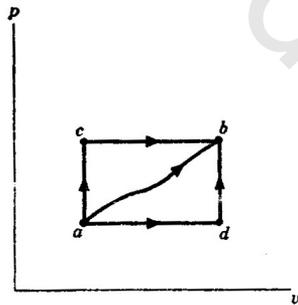
($dv = 0$) $w_v = 0$

W_p . W_p



$$W_p = p \int_{v_a}^{v_b} dv = p(v_b - v_a),$$

ab a adb : acb : : b



(a)

W

. b a

الأستاذة

20

- 1

20cm

60cm

1.67 m^3

10 m^3

$.5 \text{ m}^3$

300°K

(a)

(b)

(a)

(c)

(b)

(d)

$p - v$

(e)

P_1

T_1

k

$$p = KV$$

$p - v$

(a)

$n R T_1 P_1$

(b)

V_1

P_1

:

$P - T$

$p - v$

(a)

$n=2 \text{ Kgm moles}$:

(b)

- 6

U

$$P(v - b) RT$$

(a)

$$a = 0$$

(b)

(a)

$$P(v - b) \text{Exp}\left(\frac{a}{v} RT\right) = RT$$

b a

(a)

(b)

β

(a)

v T

ρ

1 atm

1 m³

100 atm

300°K

(a)

(b)

$$. 5 \times 10^{-10} (\text{n/m}^2)^{-1}$$

(10^{-3} m^3)
4000 atm 1 atm 0°C

K (a)

K (b)

(c)

4000 atm

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