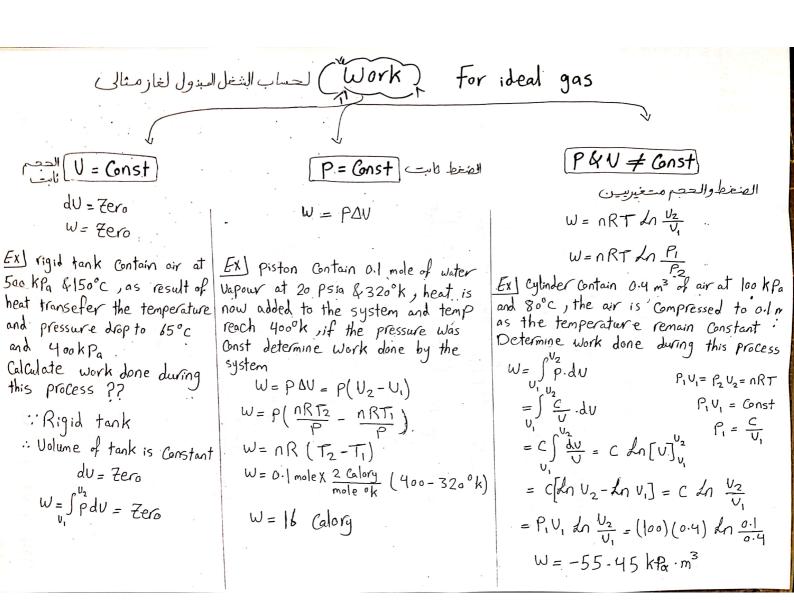
www.	Col	llea	eTa	nta	.cf
			CIU	IILU	•

سنتر فيوتشر

Subject:	رادي	لیبیا کے ا
Chapter:		نزُمو

Mob: 0112 3333 122

0109 3508 204



w.CollegeTanta.cf. work done by real gas (قيق العاز حقيق)

to calculate the work done by real gas that obey Vander Vall equation when expand at const temperature from Volume U, to final Volume U2

$$(P + \frac{\alpha n^2}{U^2})(U - nb) = nRT \rightarrow uander vall equation$$

As a & b Constant

$$P = \frac{nRT}{V - nb} - \frac{an^2}{V^2}$$

$$: W = \int_{U_1}^{U_2} p \cdot dU = \int_{U_1}^{U_2} \left(\frac{nRT}{U - nb} - \frac{an^2}{U^2} \right) \cdot dU$$

$$= \int_{U_1}^{U_2} \frac{nRT}{U - nb} \cdot dU - \int_{U_1}^{U_2} \frac{an^2}{U^2} \cdot dU$$

$$= nRT \int_{U}^{U_2} \frac{dU}{U - nb} - an^2 \int_{U}^{U_2} U^{-2} \cdot dU$$

=
$$nRT \ln \left[v - nb \right]_{v_1}^{v_2} - an^2 \left[\frac{v^{-2+1}}{-2+1} \right]_{v_2}^{v_2}$$

$$= nRT dn \left[U - nb \right]_{V_1}^{V_2} - an^2 \left[\frac{U^{-1}}{-1} \right]_{V_2}^{V_2}$$

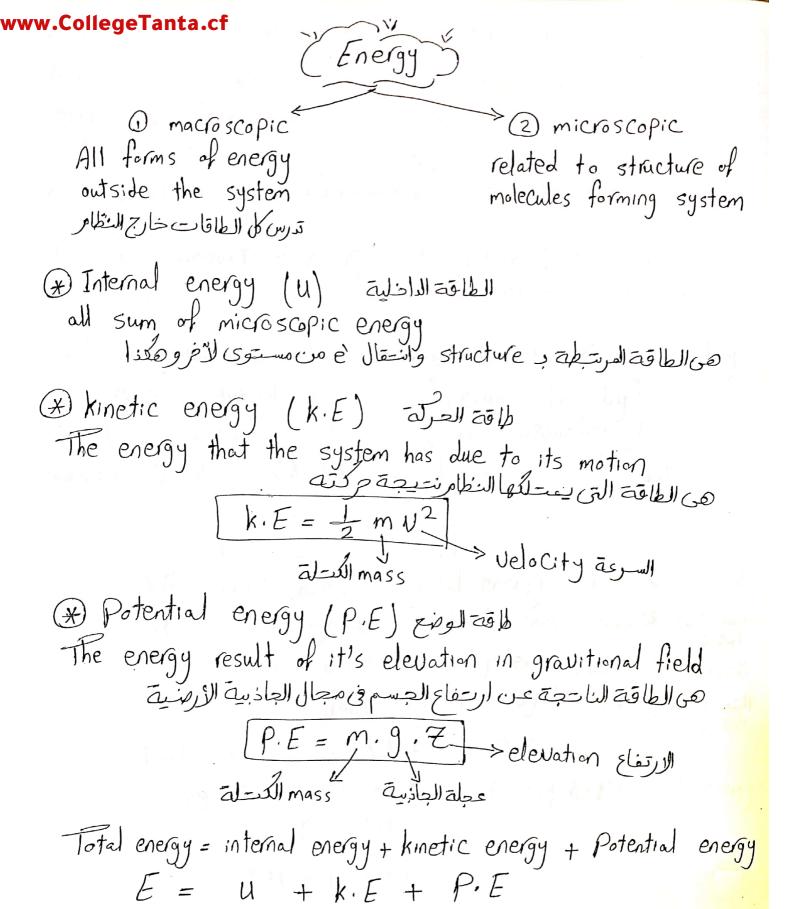
=
$$nRT dn[U-nb]_{U_1}^{V_2} + an^2(-\frac{1}{U})_{U_2}^{V_2}$$

$$= n RT \left[2n \left(V_2 - nb \right) - 2n \left(V_1 - nb \right) \right] + an^2 \left(\frac{1}{V_2} - \frac{1}{V_1} \right)$$

$$W = nRT \ln \frac{U_2 - nb}{U_1 - nb} + \alpha n^2 \left(\frac{1}{U_2} - \frac{1}{U_1}\right)$$
 For real gas

w.CollegeTanta.cf Example I find work done by 1 mole of chlorine when expands at Const temperature 50°C from volume 1 L to final volume 50 L 1) if the chlorine act as ideal gas Dif the chlorine act as real gas a = 6.493 b = 0.05 Solution Oif the chlorine act as ideal gas W=nRT Ln Uz W= (1) (0.082 Latm) (50+273)°k Ln 50 W = 103.6 L.atm 2 if the chlorine act as real gas $W = nRT \ln \left(\frac{U_2 - nb}{U_1 - nb} \right) + an^2 \left(\frac{1}{V_2} - \frac{1}{V_1} \right)$ = $(1 \text{ mole})(0.082 \frac{\text{L.atm}}{\text{mole ok}})(50+273 \text{ k}) \ln(\frac{50-1(0.05)}{1-1(0.05)})$ $+6.493\left(\frac{1}{50}-\frac{1}{1}\right)$ W= 98.747 L.atm

العازالمال الشغل المبدول في حالة الغاز الحقيقي أقل من حالة الغاز الحقيقي المناك المناكل المناكل المناكلة الغاز الحقيقي المناكلة الغاز الحقيقي المناكلة المن



DE= DU + DK.E + DP.E

* First Law of thermodynamics has three forms 1- Energy Can't be created or destroyed but it can transeter from one form to another قانون بقاء الطاقة ولاتستصري من العدم ولكن يمكن تحويلهامن مورة 2-Total amount of energy of system & surrounding are Constant and energy of system & surrounding 3- During the interaction between System & surrounding energy gained by = (energy lost by the system) = the surrounding)

The system = Ildles lbill aglico 800 peints the delada aglico 800 peints lbill agl DE = Q ± W DE -> net change in total energy عَلَقَ عَالِمًا عَالِمًا الطاقة الكلية As معدارالطاقة الكتسبة heat lost معدارالطاقة الكتسبة heat gained or heat lost المنقودة الكتسبة W -> Work done on the system المنتقل العبذ ول على النظام (or) Work done by the system about the system limited by the system But DE= Du+ DkE+DP.E neglect change in kinetic energy & Potential energy $: \Delta E = \Delta Y$ LDU = Q + W

College Tanta of thermodynamics ($\Delta E = Q \pm W$)

 $\Delta E = Q + W$ $\Delta E = Q - W$

W -ve "work done on system" -ve system" -ve system"

EX A rigid tank Contains hot fluid that is cooled while being stirred by a paddle wheel. The initial internal energy of the fluid is 800 kJ during the Cooling process, the fluid losses 500 kJ of heat, and the paddle wheel does looky of work on fluid Determine the final internal energy of the Fluid ?? Neglect the energy stored in the paddle wheel

$$\Delta E = Q + W$$

$$\Delta E = -500 + 100 = -400 \text{ kJ}$$

$$\Delta E' = \Delta U + \Delta k E + \Delta P E$$
neglect energy stored in Paddle Wheel
$$\Delta E = \Delta U = U_2 - U_1$$

$$-400 = U_2 - 800$$

$$U_2 = -400 + 800$$

$$U_2 = +400 \text{ kJ}$$

fransefer at Constant Volume DE = 9 - W But $\Delta E = \Delta u + \Delta k E + \Delta p E$: DE = DU Δu = 9 - W_{u₂} But w = Sp.du at Const Volume du= Fero W = Zero $u_2 - u_1 \leftarrow 0$: $\Delta u = 9_U$ Net change in internal energy - heat transefer at Const volume كمية العرارة المنتقلة عند معمال المستقلة العاقة الداخلية Thousand que depend on initial and Final state of internal energy Wet heat transefer at constant pressure $\Delta E = 9 - W$ W=PAU at Const pressure $9 = \Delta E + \omega$ DE = QU ا عندبيوت اضغط (2p = ΔU + PΔV) 9p = (Uz-U1) + P(U2-U1) 9p = u2 -u1 + PU2 -PU1 9p = U2+ PU2 - (U, +PU1) 2p = H2 - H, $9_p = \Delta H$ net change in enthalpy = net change in heat transeter at كعية العرارة المنتقلة عند منغط كابت = محصلة التغيير في المحتوى العراري about of heat content

is thermodynamic quantity equivalent to heat content of system مى كمية ترموديناميكية مكافئة للمحتى العرارى للنظام > change in enthalpy associated to particular chemical process التعنيرفي المحتوى العراري مرسبط جزئياً بالعملية الكيميائية * Relation between 9p & 9v 00 $q_{p} = \Delta u + p \Delta v$ $q_p = \Delta u + W \implies q_p = q_v + W$ Sep 7 9 9p is larger than 9, by work ا ملعوظة هامة مرآآ at const volume the increase in heat transefer of to increase in internal energy qu - at Const pressure the increase in heat transefer Cogo to Work

> 90 to increase in internal energy

 $Q_{\rho} = \Delta u + w$