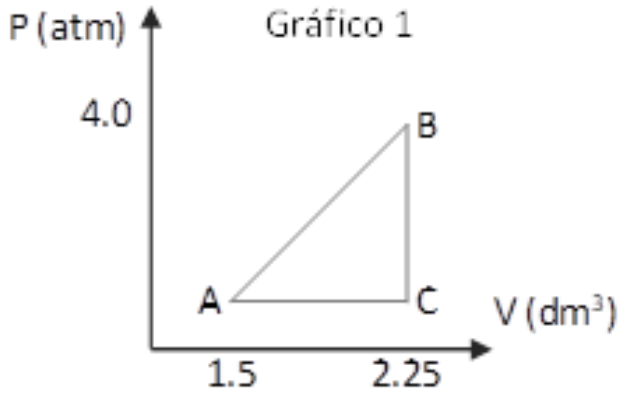
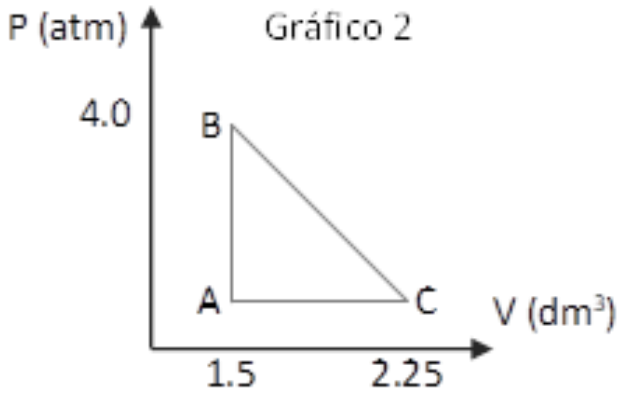
G4A. PROBLEMA 2

0.2 moles de un gas ideal (M_M = 30 g/mol) que posee c_P= 1 J/g·K y c_V = 0.72 J/g·K, se encuentran inicialmente en el estado A con una temperatura de 200 K y realizan los siguientes ciclos





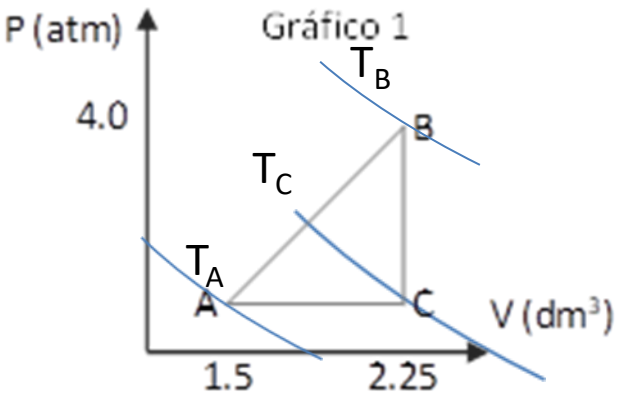
a) Calcular ΔU y ΔH en A → B para cada uno de los gráficos.

b) Calcular ΔU y ΔH en B → C para cada uno de los gráficos.

Dato: 1 L atm = 101,39 J

Rta: a) Gráfico 1: ΔH = 2094 J y ΔU = 1508 J, Gráfico 2: ΔH = 996 J y ΔU = 717 J.
b) Gráfico 1: ΔH = -1494 J y ΔU = -1076 J, Gráfico 2: ΔH = -396 J y ΔU = -285 J

Gráfico 1



Estado A

T_A = 200 K

V_A = 1,5 dm³

n = 0,2 mol

$P_A = \frac{nRT_A}{V_A}$ = 2,187 atm

Estado B

P_B = 4 atm

V_B = 2,25 dm³

n = 0,2 mol

$T_B = \frac{P_B V_B}{nR}$ = 549 K

Estado C

P_C = 2,187 atm

V_C = 2,25 dm³

n = 0,2 mol

$T_C = \frac{P_C V_C}{nR}$ = 300 K

$c_v = 0{,}72 \frac{J}{g\,K} = 0{,}72 * 30 \frac{g}{mol} = 21{,}6 \frac{J}{molK}$

$c_P = 1 \frac{J}{g\,K} = 1 * 30 \frac{g}{mol} = 30 \frac{J}{molK}$

Camino AB

$\Delta U_{AB} = Q_{AB} + W_{AB}$

$\Delta U_{AB} = U_B - U_A = n\, c_v\, (T_B - T_A)$

ΔU_{AB} = 0,2mol. 21,6 J/molK.(549 – 200)K

ΔU_{AB} = 1508 J

$\Delta H_{AB} = H_B - H_A = n\, c_P\, (T_B - T_A)$

ΔH_{AB} = 0,2mol. 30 J/molK.(549 – 200)K

ΔH_{AB} = 2094 J

Camino BC

$\Delta U_{BC} = Q_{BC} + W_{BC}$

$\Delta U_{BC} = U_C - U_B = n\, c_v\, (T_C - T_B)$

ΔU_{BC} = 0,2mol. 21,6 J/molK.(300 – 549)K

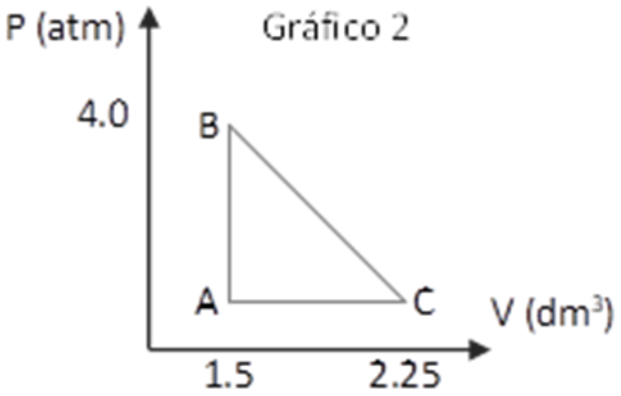
ΔU_{BC} = - 1076 J

$\Delta H_{BC} = H_C - H_B = n\, c_P\, (T_C - T_B)$

ΔH_{AB} = 0,2mol. 30 J/molK.(300 – 549)K

ΔH_{AB} = - 1494 J

Gráfico 2



Estado A

T_A = 200 K

V_A = 1,5 dm^3

n = 0,2 mol

$P_A = \frac{nRT_A}{V_A}$ = 2,187 atm

Estado B

P_B = 4 atm

V_B = 1,5 dm^3

n = 0,2 mol

$T_B = \frac{P_B V_B}{nR}$ = 366 K

Estado C

P_C = 2,187 atm

V_C = 2,25 dm^3

n = 0,2 mol

$T_C = \frac{P_C V_C}{nR}$ = 300 K

$c_v = 0{,}72 \frac{J}{g\,K} = 0{,}72 * 30 \frac{g}{mol} = 21{,}6 \frac{J}{molK}$

$c_P = 1 \frac{J}{g\,K} = 1 * 30 \frac{g}{mol} = 30 \frac{J}{molK}$

Camino AB

$\Delta U_{AB} = Q_{AB} + W_{AB}$

$\Delta U_{AB} = U_B - U_A = n\, c_v\, (T_B - T_A)$

ΔU_{AB} = 0,2mol. 21,6 J/molK.(366 – 200)K

ΔU_{AB} = 717 J

$\Delta H_{AB} = H_B - H_A = n\, c_P\, (T_B - T_A)$

ΔH_{AB} = 0,2mol. 30 J/molK.(366 – 200)K

ΔH_{AB} = 996 J

Camino BC

$\Delta U_{BC} = Q_{BC} + W_{BC}$

$\Delta U_{BC} = U_C - U_B = n\, c_v\, (T_C - T_B)$

ΔU_{BC} = 0,2mol. 21,6 J/molK.(300 – 366)K

ΔU_{BC} = - 285 J

$\Delta H_{BC} = H_C - H_B = n\, c_P\, (T_C - T_B)$

ΔH_{AB} = 0,2mol. 30 J/molK.(300 – 366)K

ΔH_{AB} = - 396 J