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McCord CHf301

Exam 4

Summer 2016

Thermodynamic Data at 25°C

Substance	ΔH_f° kJ/mol	S° J/mol K
CH_4 (g)	-75	186
C_3H_8 (g)	-104	270
C_5H_{12} (ℓ)	-174	263
CO (g)	-111	198
CO_2 (g)	-394	214
$COCl_2$ (g)	-220	284
Cl_2 (g)	—	223
H_2O (ℓ)	-286	70
H_2O (g)	-242	189
NO_2 (g)	33	240
NO (g)	91	211
N_2H_4 (ℓ)	50	12
N_2O (g)	82	220
O_2 (g)	—	205

Single Bond Energies (kJ/mol)

	H	C	N	O	S	Br
H	436					
C	413	346				
N	391	305	163			
O	463	358	201	146		
S	347	272	—	—	226	
Br	366	285	—	201	217	193

Multiple Bond Energies (kJ/mol)

C=C 602	C=N 615	C=O 799
C≡C 835	C=S 577	C≡O 1072
N=N 418	O=O 498	N≡N 945

$\Delta U = q + w \qquad H = U + PV$

$w = -P\Delta V \qquad w = -\Delta nRT$

$\Delta U = \Delta H - P\Delta V$

$\Delta U = \Delta H - \Delta nRT$

$\Delta U = q_v = n\,C_v\,\Delta T$

$\Delta H = q_p = n\,C_p\,\Delta T$

$q_{sys} = -q_{cal}$

$q_{cal} = q_{water} + q_{hardware}$

$\Delta S = q_{rev}/T \qquad S = k \ln W$

$\Delta S = n\,C_m \ln\left(\frac{T_2}{T_1}\right)$

$\Delta H_{rxn} = \Delta H_1 + \Delta H_2 + \Delta H_3 + \cdots$

$\Delta H^\circ_{rxn} = \sum n\Delta H^\circ_f(\text{prod}) - \sum n\Delta H^\circ_f(\text{react})$

$\Delta H_{rxn} = \sum BE_{reactants} - \sum BE_{products}$

$\Delta G^\circ_{rxn} = \sum n\Delta G^\circ_f(\text{prod}) - \sum n\Delta G^\circ_f(\text{react})$

$\Delta S^\circ_{rxn} = \sum nS^\circ(\text{prod}) - \sum nS^\circ(\text{react})$

$G = H - TS \qquad \Delta G = \Delta H - T\Delta S$

$\Delta S_{trans} = \Delta H_{trans}/T_{trans}$

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