

Heat of Formation Problems

Key

Use the standard enthalpies of formation to calculate H°_{rxn} for each of these reactions.

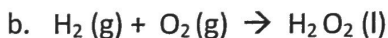
Compound/Element	ΔH°_f kJ/mol
H ₂ (g)	0
O ₂ (g)	0
H ₂ O (g)	-242
H ₂ O (l)	-286
H ₂ O ₂ (l)	-188
NH ₃ (g)	-46
NH ₄ Cl (s)	-314
HCl (g)	-92
FeS (s)	-102
Fe ₂ O ₃ (s)	-824
SO ₂ (g)	-297
NaHCO ₃ (s)	-951
Na ₂ CO ₃ (s)	-1131
NaOH (s)	-426.7
NaCl (s)	-411
CO ₂ (g)	-394
CO (g)	-110.5
CH ₄ (g)	-74.8
H ₂ S (g)	-21
NO (g)	+90.4
NO ₂ (g)	+33.9

$$\sum \Delta H_p - \sum \Delta H_r$$



$$[-1131 \text{ kJ} + -394 \text{ kJ} + -242 \text{ kJ}] - [2(-951 \text{ kJ})]$$

$$[-1767 \text{ kJ}] - [-1902 \text{ kJ}] = 135 \text{ kJ/mol}$$

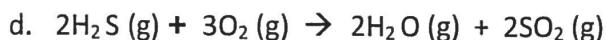


$$[-188 \text{ kJ}] - [0 \text{ kJ} + 0 \text{ kJ}] = -188 \text{ kJ/mol}$$



$$[-314 \text{ kJ}] - [-46 \text{ kJ} + -92 \text{ kJ}]$$

$$[-314 \text{ kJ}] - [-138 \text{ kJ}] = -176 \text{ kJ/mol}$$



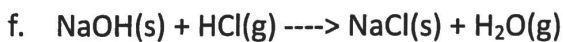
$$[2(-242 \text{ kJ}) + 2(-297 \text{ kJ})] - [2(-21 \text{ kJ}) + 3(0 \text{ kJ})]$$

$$[-484 + -594] - [-42 \text{ kJ}]$$

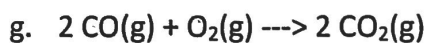
$$[-1078] - [-42] = -1036 \text{ kJ/mol}$$



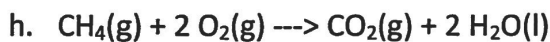
$$\begin{aligned} & [2(-824\text{kJ}) + 4(-297\text{kJ})] - [4(-102\text{kJ}) + 7(0\text{kJ})] \\ & \begin{array}{r} [-1648 + -1188] - [-408] \\ -2836 - -408 \end{array} = -2428\text{kJ/mol} \end{aligned}$$



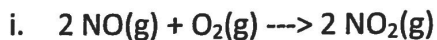
$$\begin{aligned} & [-411\text{kJ} + -242\text{kJ}] - [-426.7\text{kJ} + -92\text{kJ}] \\ & [-653\text{kJ}] - [-518.7\text{kJ}] = -134.3\text{kJ/mol} \end{aligned}$$



$$\begin{aligned} & [2(-394\text{kJ})] - [2(-110.5\text{kJ}) + 0\text{kJ}] \\ & [-788\text{kJ}] - [-221\text{kJ}] = -567\text{kJ/mol} \end{aligned}$$



$$\begin{aligned} & [-394\text{kJ} + 2(-286\text{kJ})] - [-14.8\text{kJ} + -2(0\text{kJ})] \\ & \begin{array}{r} -572\text{kJ} \\ [-966\text{kJ}] - [-74.8\text{kJ}] \end{array} = -891.2\text{kJ/mol} \end{aligned}$$



$$\begin{aligned} & [2(33.9\text{kJ})] - [2(90.4\text{kJ}) + 0\text{kJ}] \\ & [67.8\text{kJ}] - [180.8\text{kJ}] = -113\text{kJ/mol} \end{aligned}$$