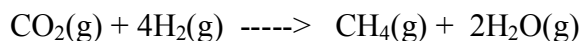


Chapter 6 - Lecture Worksheet 3

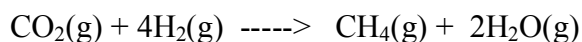
Using standard heats of formation, calculate the standard enthalpy change for the following reaction.



$$\begin{aligned}\Delta H^{\circ}_{\text{rxn}} &= \Delta H^{\circ}_f(\text{CH}_4, \text{g}) + 2\Delta H^{\circ}_f(\text{H}_2\text{O}, \text{g}) - \Delta H^{\circ}_f(\text{CO}_2, \text{g}) - 4\Delta H^{\circ}_f(\text{H}_2, \text{g}) \\ &= -75 + 2(-242) - (-394) - 4(0) \text{ kJ} = -165 \text{ kJ}\end{aligned}$$

(1) -711 kJ (2) -165 kJ (3) -15 kJ (4) 15 kJ (5) 165 kJ (6) 229 kJ (7) 711 kJ

Using average bond enthalpies estimate the standard enthalpy change for the same reaction.



$$\begin{aligned}\Delta H^{\circ}_{\text{rxn}} &\approx 2BE(\text{C}=\text{O}) + 4BE(\text{H}-\text{H}) - 4BE(\text{C}-\text{H}) - 4BE(\text{O}-\text{H}) \\ &\approx 2(728) + 4(436) - 4(413) - 4(463) \text{ kJ} = -304 \text{ kJ}\end{aligned}$$

Which is more accurate ? Why ?

ΔH° calculated from ΔH°_f is more accurate because ΔH° calculated from bond enthalpies uses AVERAGE bond enthalpies obtained from a number of different compounds in which the bonds arise and are not specific to the compound in question.

	<u>Standard Enthalpy of formation (kJ/mol)</u>
CH ₄ (g)	-75
CO ₂ (g)	-394
C ₂ H ₂ (g)	+227
H ₂ O(g)	-242
H ₂ O(l)	-286
NH ₃ (g)	-46
HCl(g)	-92
HCl(aq)	-167
CaCO ₃ (s)	-1208
Ca(OH) ₂ (aq)	-1003
Ca(OH) ₂ (s)	-986
CaO(s)	-635
SO ₂ (g)	-297
SO ₃ (g)	-396

	<u>Average Bond Enthalpies (kJ/mol)</u>
H-H	436
N-H	391
N-N	161
N=N	418
N≡N	945
O-H	463
C-O	351
C=O	728
C≡O	1072
Cl-Cl	242
Cl-H	432
Br-Br	193
Br-H	366
C-H	413