

6 • Energy & Chemical Thermodynamics**PRACTICE TEST**

Information about the substances involved in the reaction represented above is summarized in the following tables.

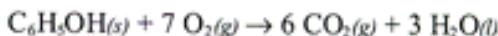
Substance	ΔH°_f (kJ/mol)
$\text{C}_2\text{H}_2(\text{g})$	226.7
$\text{C}_2\text{H}_6(\text{g})$	-84.7

- (a) Write the equation for the heat of formation of $\text{C}_2\text{H}_6(\text{g})$



- (b) Use the above information to determine the enthalpy of reaction for the equation given.

$$\begin{aligned}\Delta H_{rxn} &= \Delta H_f \text{ C}_2\text{H}_6 - \Delta H_f \text{ C}_2\text{H}_2 \\ &= -84.7 \text{ kJ} - (226.7) \text{ kJ} \\ &= \boxed{-311.4 \text{ kJ/mol}}\end{aligned}$$



When a 2.000-gram sample of pure phenol, $\text{C}_6\text{H}_5\text{OH}(\text{s})$, is completely burned according to the equation above, 64.98 kilojoules of heat is released. Use the information in the table below to answer the questions that follow.

- Sign
for ΔH

Substance	Standard Heat of Formation, ΔH°_f , at 25°C (kJ/mol)
$\text{CO}_2(\text{g})$	-393.5
$\text{H}_2\text{O}(\text{l})$	-285.85
$\text{C}_6\text{H}_5\text{OH}(\text{s})$?

$$\begin{aligned}C_6 &= 72.066 \text{ g} \\ H_6 &= 6.0474 \text{ g} \\ O &= 16.00 \text{ g} \\ &\hline 94.113 \text{ g/mol}\end{aligned}$$

- (a) Calculate the molar heat of combustion of phenol in kilojoules per mole at 25°C.

$$\Delta H_{\text{combustion}} = \frac{-64.98 \text{ kJ}}{2.000 \text{ g C}_6\text{H}_5\text{OH}} \times \frac{94.113 \text{ g C}_6\text{H}_5\text{OH}}{1 \text{ mol C}_6\text{H}_5\text{OH}} = \boxed{3058 \frac{\text{kJ}}{\text{mol}}}$$

- (b) Calculate the standard heat of formation, ΔH°_f , of phenol in kilojoules per mole at 25°C.

$$\begin{aligned}\Delta H_{\text{combustion}} &= 6(\Delta H_f \text{ CO}_2) + 3(\Delta H_f \text{ H}_2\text{O}) - \Delta H_f \text{ C}_6\text{H}_5\text{OH} \\ -3058 \frac{\text{kJ}}{\text{mol}} &= 6(-393.5) + 3(-285.85) - x \\ x &= 6(-393.5) + 3(-285.85) + 3058 \text{ kJ/mol} \\ &= -2361 - 857.55 + 3058 \text{ kJ/mol} \\ \text{C}_6\text{H}_5\text{OH} \quad \Delta H_f &= \boxed{-160.6 \text{ kJ/mol}}\end{aligned}$$