Chapter 5

1. It is found that 6.00 g of potassium metal reacts with excess water to release 29.8 kJ of heat. This means that, for the reaction

\[ 2 \text{K(s)} + 2 \text{H}_2\text{O(l)} \rightarrow \text{KOH(aq)} + \text{H}_2(g) \]

the enthalpy of reaction (per mole of H\(_2\) produced) is

A. \( \Delta H = +189 \text{ kJ} \)
B. \( \Delta H = -4.97 \text{ kJ} \)
C. \( \Delta H = +388 \text{ kJ} \)
D. \( \Delta H = -194 \text{ kJ} \)
E. None of the above is within 1\% of the correct answer

2. Given the following reactions and their enthalpy changes

\[
\begin{align*}
2 \text{C}_2\text{H}_2(\text{g}) + 5 \text{O}_2(\text{g}) & \rightarrow 4 \text{CO}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{l}) & \Delta H_{\text{fRXN}} = -2599.2 \text{ kJ} \\
4 \text{CO}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{l}) & \rightarrow \text{C(s)} + \text{O}_2(\text{g}) & \Delta H_{\text{fRXN}} = -393.5 \text{ kJ} \\
2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) & \rightarrow 2 \text{H}_2\text{O}(\text{l}) & \Delta H_{\text{fRXN}} = -571.8 \text{ kJ}
\end{align*}
\]

Calculate \( \Delta H^\circ_f \) for acetylene, \( \text{C}_2\text{H}_2(\text{g}) \).

A. 620.2 kJ
B. -620.2 kJ
C. 453.4 kJ
D. 226.7 kJ
E. None of the above is within 10\% of the correct answer

3. The value of \( \Delta H^\circ \) for the following reaction is

\[ \text{SO}_2\text{Cl}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{SO}_4(\text{l}) + 2 \text{HCl(g)} \]

A. -184
B. -372
C. -1079
D. 30
E. -92
4. For which one of the following equations is $\Delta H^{\circ}_{\text{rxn}}$ equal to $\Delta H^{\circ}_{f}$ for the product?

A. $\text{Xe}(g) + 2\text{F}_2(g) \rightarrow \text{XeF}_4(g)$  
B. $\text{CH}_4(g) + 2\text{Cl}_2(g) \rightarrow \text{CH}_2\text{Cl}_2(\ell) + 2 \text{HCl}(g)$  
C. $\text{N}_2(g) + \text{O}_3(g) \rightarrow \text{N}_2\text{O}_3(g)$  
D. $2 \text{CO}(g) + \text{O}_2(g) \rightarrow 2 \text{CO}_2(g)$  
E. None of the above have $\Delta H^{\circ}_{\text{rxn}}$ equal to $\Delta H^{\circ}_{f}$

5. The standard heat of formation for $\text{H}_2\text{O}(g)$ is $-241.8$ kJ/mol, and for $\text{NaOH}(s)$ it is $-425.6$ kJ/mol. The enthalpy change for the reaction between $\text{Na}(s)$ and $\text{H}_2\text{O}(g)$ to produce $\text{NaOH}(s)$ and $\text{H}_2(g)$ is, per mole of $\text{H}_2(g)$ produced,

A. $-367.6$ kJ  
B. $-183.8$ kJ  
C. $-667.4$ kJ  
D. not determinable from the data given  
E. None of the above answers is correct

6. The standard heat of formation of ammonia, $\text{NH}_3(g)$, is $-46.2$ kJ/mole. Which of the following is true about the reaction:

$$2 \text{NH}_3(g) \rightarrow 3 \text{H}_2(g) + \text{N}_2(g)$$

A. The reaction is exothermic with $\Delta H = -46.2$ kJ.  
B. The reaction is endothermic with $\Delta H = -92.4$ kJ.  
C. The reaction is exothermic with $\Delta H = 92.4$ kJ.  
D. The reaction is endothermic with $\Delta H = 92.4$ kJ.  
E. The reaction is endothermic with $\Delta H = 46.2$ kJ.

7. 0.0100 mole of dry, solid $\text{KClO}_3$ is added to 50.0 g of water at 20.10°C in a coffee–cup calorimeter. The temperature is observed to drop to 18.10°C. $\Delta H$ of hydration for one mole of $\text{KClO}_3$ is (within 2%) [Heat capacity of water = 4.18 J/°C g]

A. $-0.836$ kJ  
B. 0.836 kJ  
C. $-41.8$ kJ  
D. 41.8 kJ  
E. None of the above answers is correct.