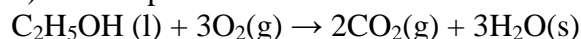


Exercise Series N° 3

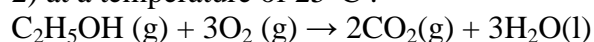
Exercise 1:

Calculate the difference between the heat of reaction at constant volume and the heat of reaction at constant pressure in the following two cases:

1) at a temperature of 0°C:

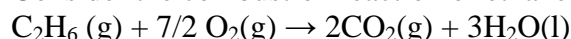


2) at a temperature of 25°C :



Exercise 2:

Consider the combustion reaction of ethane at 25°C and 1 atm:



1. Calculate the enthalpy change of this reaction ΔH_R° at 25°C. What does the sign of the value found mean?

2. Calculate the internal energy change ΔU_R° accompanying this reaction at 25°C.

Data at 25°C: $\Delta H_f^\circ (\text{H}_2\text{O} (\text{l})) = -285,8 \text{ KJ/mol}$, $\Delta H_f^\circ (\text{CO}_2 (\text{g})) = -394,0 \text{ KJ/mol}$,
 $\Delta H_f^\circ (\text{C}_2\text{H}_6 (\text{g})) = -84,7 \text{ KJ/mol}$.

Exercise 3:

I. The combustion of one mole of liquid methanol, $\text{CH}_3\text{OH}(\text{l})$, releases 724 kJ at $T=298\text{K}$ and $P=1\text{atm}$.

a. Write the combustion reaction of methanol at 298 K.

b. Calculate the standard enthalpy of formation of liquid methanol (ΔH_f°) at 298K, deduce the enthalpy of formation of gaseous methanol.

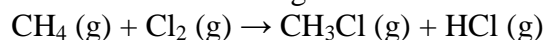
II. Calculate the bond energy (O-H) in gaseous methanol?

Data: at 298K: $\Delta H_f^\circ (\text{CO}_2 (\text{g})) = -393 \text{ KJ/mol}$, $\Delta H_f^\circ (\text{H}_2\text{O} (\text{l})) = -285 \text{ KJ/mol}$,
 $\Delta H_{\text{vap}}^\circ (\text{CH}_3\text{OH}) = +39 \text{ KJ/mol}$, $\Delta H_{\text{sub}}^\circ (\text{C}) = +714 \text{ KJ/mol}$

Bond	H-H	C-H	C-O	O=O
$\Delta H_{\text{diss}}^\circ (\text{KJ/mol})$	436	415	350	464

Exercise 4:

Consider the following reaction at 298K:



1. Calculate the standard enthalpy of reaction ΔH_R° at 298K.

2. Calculate the bond energy of the C-H bond at 298K.

3. Calculate the standard molar enthalpy of sublimation of carbon at 298K.

Data:

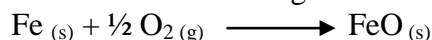
$\Delta H_f^\circ,_{298}(\text{CH}_4, \text{g}) = -17,9 \text{ kcal/mol}$, $\Delta H_f^\circ,_{298}(\text{CH}_3\text{Cl}, \text{g}) = -20 \text{ kcal/mol}$, $\Delta H_f^\circ,_{298}(\text{HCl}, \text{g}) = -22 \text{ kcal/mol}$

$\Delta H^\circ_{298}(\text{Cl-Cl}) = -58 \text{ kcal/mol}$, $\Delta H^\circ_{298}(\text{C-Cl}) = -78 \text{ kcal/mol}$

$\Delta H^\circ_{298}(\text{H-Cl}) = -103 \text{ kcal/mol}$, $\Delta H^\circ_{298}(\text{H-H}) = -104 \text{ kcal/mol}$

Exercise 5:

Consider the following reaction:



1. Calculate the standard enthalpy of reaction ΔH°_R at $T_0=298 \text{ K}$.

2. Calculate ΔH°_R of the reaction at $T_1=1700 \text{ K}$ and $T_2=1900 \text{ K}$, knowing that $\Delta H^\circ_{\text{fusion}}(\text{Fe})=14.9 \text{ kJ/mol}$ at $T_f=1807 \text{ K}$.

Data: at 298K : $\Delta H_f^\circ (\text{FeO} (\text{s})) = -272,04 \text{ KJ/mol}$, $C_p (\text{Fe} (\text{s})) = 24,9 \text{ J/K.mol}$, $C_p (\text{Fe} (\text{l})) = 46 \text{ J/K.mol}$,
 $C_p (\text{O}_2 (\text{g})) = 29,4 \text{ J/K.mol}$, $C_p (\text{FeO} (\text{s})) = 49,70 \text{ J/K.mol}$