12-2 Practice Problems

Show work.

1. How much heat will be released when 6.44-g of Sulfur reacts with excess O_2 according to the following equation?
$2S + 3O_2 \rightarrow 2SO$ $\Delta H° = -791.4\text{-kJ}$

2. How much heat will be released when 4.72-g of Carbon reacts with excess O_2 according to the following equation?
$C + O_2 \rightarrow CO_2$ $\Delta H° = -393.5\text{-kJ}$

3. How much heat will be absorbed when 38.2-g of Bromine reacts with excess H_2 according to the following equation?
$H_2 + Br_2 \rightarrow 2HBr$ $\Delta H° = 72.80\text{-kJ}$

4. How much heat will be transferred when 14.9-g of ammonia reacts with excess O_2 according to the following equation?
$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ $\Delta H° = -1170\text{-kJ}$

5. How much heat will be released when 1.48-g of Chlorine Gas reacts with excess P according to the following equation? Is this reaction endothermic or exothermic?
$2P + 5C1_2 \rightarrow 2PCl_5$ $\Delta H° = -886\text{-kJ}$

6. How much heat will be released when 13.7-g of Nitrogen reacts with excess O_2 according to the following equation?
$N_2 + O_2 \rightarrow 2NO$ $\Delta H° = 180\text{-kJ}$

7. How much heat will be released when 11.8-g of Iron reacts with excess O_2 according to the following equation?
$3Fe + 2O_2 \rightarrow Fe_3O_4$ $\Delta H° = -1120.48\text{-kJ}$

8. How much heat will be released when 18.6-g of Hydrogen reacts with excess O_2 according to the following equation?
$2H_2 + O_2 \rightarrow 2H_2O$ $\Delta H° = -571.6\text{-kJ}$

9. How much heat will be released when 4.77-g of ethanol reacts with excess O_2 according to the following equation?
$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ $\Delta H° = -1366.7\text{-kJ}$

10. How much heat will be transferred when 5.81-g of graphite reacts with excess H_2 according to the following equation? Is this reaction endothermic or exothermic?
$6C + 3H_2 \rightarrow C_6H_6$ $\Delta H° = 49.03\text{ kJ}$

12-3 Practice Problems

Use Hess's law to determine the following enthalpy changes. Show work.

1. From the following enthalpy changes,
$C + ½O_2 \rightarrow CO$ $\Delta H° = -110.5\text{-kJ}$
$CO + ½O_2 \rightarrow CO_2$ $\Delta H° = -283.0\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$C + O_2 \rightarrow CO_2$.

2. From the following enthalpy changes,
$2P + 3Cl_2 \rightarrow 2PC1_3$ $\Delta H° = -640\text{-kJ}$
$2P + 5C1_2 \rightarrow 2PCl_5$ $\Delta H° = -886\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$PC1_3 + Cl_2 \rightarrow PCl_5$.

3. From the following enthalpy changes,
$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ $\Delta H° = -\text{l } 234.7\text{-kJ}$
$CH_3OCH_3 + 3O_2 \rightarrow 2CO_2 + 3H_2O$ $\Delta H° = -1328.3\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$C_2H_5OH \rightarrow CH_3OCH_3$.

4. From the following enthalpy changes,
$Cu + Cl_2 \rightarrow CuCl_2$ $\Delta H° = -206\text{-kJ}$
$2Cu + Cl_2 \rightarrow 2CuCl$ $\Delta H° = -136\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$CuCl_2 + Cu \rightarrow 2CuCl$.

5. From the following enthalpy changes,
$H_2 + F_2 \rightarrow 2HF$ $\Delta H° = -542.2\text{-kJ}$
$2H_2 + O_2 \rightarrow 2H_2O$ $\Delta H° = -571.6\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$2F_2 + 2H_2O \rightarrow 4HF + O_2$.

6. From the following enthalpy changes,
$Xe + F_2 \rightarrow XeF_2$ $\Delta H° = -123\text{-kJ}$
$Xe + 2F_2 \rightarrow XeF_4$ $\Delta H° = -262\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$XeF_2 + F_2 \rightarrow XeF_4$.

7. From the following enthalpy changes,
$2Al + 3/2O_2 \rightarrow Al_2O_3$ $\Delta H° = -1601\text{-kJ}$
$2Fe + 3/2O_2 \rightarrow Fe_2O_3$ $\Delta H° = -821\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3$.

8. From the following enthalpy changes,
$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ $\Delta H° = -1170\text{-kJ}$
$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$ $\Delta H° = -1530\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$N_2 + O_2 \rightarrow 2NO$.

9.From the following enthalpy changes,
$H_2O_2 \rightarrow H_2O + ½O_2$ $\Delta H° = -94.6\text{-kJ}$
$H_2 + ½O_2 \rightarrow H_2O$ $\Delta H° = -286.0\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$H_2 + H_2O_2 \rightarrow 2H_2O$.

10. From the following enthalpy changes,
$C + O_2 \rightarrow CO_2$ $\Delta H° = -393.5\text{-kJ}$
$H_2 + ½O_2 \rightarrow H_2O$ $\Delta H° = -285.8\text{-kJ}$
$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$ $\Delta H° = -2598.8\text{-kJ}$
calculate the value of $\Delta H°$ for the reaction
$2C + H_2 \rightarrow C_2H_2$

12-4 Practice Problems

Show work.

1. When a 12.8-g sample of KCl dissolves in 75.0-g of water in a calorimeter, the temperature drops from 31.0°C to 21.6°C. Calculate ΔH for the process.
$KCl \rightarrow K^+ + Cl^-$

~~2. What is the specific heat of aluminum if the temperature of a 28.4-g sample of aluminum is increased by 8.1°C when 207-J of heat is added?~~

3. When a 25.7-g sample of NaI dissolves in 80.0-g of water in a calorimeter, the temperature rises from 20.5°C to 24.4°C. Calculate ΔH for the process.
$NaI \rightarrow Na^+ + I^-$

~~4. What is the specific heat of silicon if the temperature of a 4.11-g sample of silicon is increased by 3.8°C when 11.1-J of heat is added?~~

5. When a 16.9-g sample of NaOH dissolves in 70.0-g of water in a calorimeter, the temperature rises from 22.4°C to 86.6°C. Calculate ΔH for the process.
$NaOH \rightarrow Na^+ + OH^-$

6. When a 19.2-g sample of KCN dissolves in 65.0-g of water in a calorimeter, the temperature drops from 28.1°C to 15.4°C. Calculate ΔH for the process.
$KCN \rightarrow K^+ + CN^-$

~~7. What is the specific heat of gold if the temperature of a 8.21-g sample of gold is increased by 6.2°C when 6.51-J of heat is added?~~

8. When a 28.7-g sample of KI dissolves in 60.0 g of water in a calorimeter, the temperature drops from 27.2°C to 13.2°C. Calculate ΔH for the process.
$KI \rightarrow K^+ + I^-$

~~9. What is the specific heat of silver if the temperature of a 15.4-g sample of silver is increased by 11.2°C when 40.5-J of heat is added?~~

~~10. What is the specific heat of Titanium if the temperature of a 36.7-g sample of titanium is increased by 4.8°C when 91.6-J of heat is added?~~