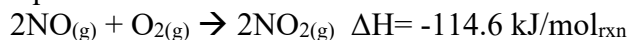
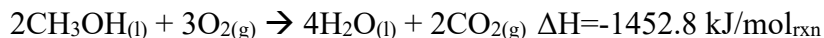


Enthalpy Problem Set

1. Determine the amount of heat (in kJ) given off when 1.26×10^4 g of NO_2 are produced according to the equation:



2. Consider this reaction:



What is the value of ΔH if... a) the equation is multiplied throughout by 2.

b) the direction of the reaction is reversed.

c) water vapor instead of liquid water is produced.

d) if you combust 12.23 g of methanol what would be the q?

3. A piece of silver of mass 362 g has a heat capacity of $85.7 \text{ J/}^\circ\text{C}$. What is the **specific** heat of silver?

4. Calculate the amount of heat liberated (in kJ) from 366 g of mercury when it cools from 77.0°C to 12.0°C .

5. A sheet of gold weighing 10.0 g and a temperature of 18.0°C is placed flat on a sheet of iron weighing 20.0 g and at a temperature of 55.6°C . What is the final temperature of the combined metals?

6. To a sample of water at 23.4°C in a constant-pressure calorimeter of negligible heat capacity is added a 12.1 g piece of Aluminum whose temperature is 81.7°C . If the final temperature of the water is 24.9°C calculate the mass of the water in the calorimeter.

7. A 0.1375 g sample of solid magnesium is burned in a constant-volume bomb calorimeter that has a heat capacity of $3014 \text{ J/}^\circ\text{C}$. The temperature increases by 1.126°C . Calculate the heat given off by the burning Mg, in kJ/g and in kJ/mol.

8. The standard enthalpies of formation of ions in aqueous solutions are obtained by arbitrarily assigning a value of zero to H^+ ions; that is $\Delta H^\circ_f (\text{H}^+_{(\text{aq})}) = 0$

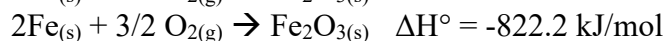
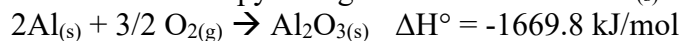
a) For the following reaction, $\text{HCl}_{(\text{g})} \rightarrow \text{H}^+_{(\text{aq})} + \text{Cl}^-_{(\text{aq})}$ $\Delta H^\circ = -74.9 \text{ kJ/mol}$

calculate the ΔH°_f of $\text{Cl}^-_{(\text{aq})}$.

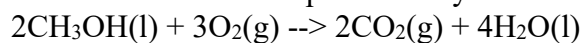
b) Given that ΔH°_f for OH^- ions is -229.6 kJ/mol , calculate the enthalpy of neutralization when 1 mole of a strong monoprotic acid (such as HCl) is titrated by 1 mole of strong base (such as KOH) at 25°C .

9. Calculate the heat of combustion for: $\text{C}_2\text{H}_{4(\text{g})} + 3\text{O}_{2(\text{g})} \rightarrow 2\text{CO}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{l})}$

10. Calculate the standard enthalpy change for the reaction: $2\text{Al}_{(\text{s})} + \text{Fe}_2\text{O}_{3(\text{s})} \rightarrow 2\text{Fe}_{(\text{s})} + \text{Al}_2\text{O}_{3(\text{s})}$ given that...



12. The combustion of methanol is represented by the following chemical equation:



If the enthalpy of combustion for this reaction is -1452 kJ answer the following:

- How much energy would be liberated by the combustion of 10.5 g of ethanol?
- How much energy would be liberated if 3.75 g of water is produced in this reaction?
- What mass of methanol must be burned in order to heat 500.0 g of water from 20.0°C to 95.5°C?

13. When 13.4g of ammonium chloride is mixed with 2.00×10^2 g of water it dissociates into ions and causes the temperature of the solution to drop from 20.0°C to 15.3°C.

- Determine the molar enthalpy of solution for ammonium chloride.
- Write the thermochemical equation for the reaction.
- Sketch the enthalpy diagram for the above reaction.