Dr. Taylor **Chapter 10 Homework** **Chem 111**

1. Define the term: system.

2. Consider this reaction: $2CH_3OH(l) + 3O_2(g) \rightarrow 4H_2O(l) + 2CO_2(g)$ $\Delta H = -1452.8$ kJ/mol
What is the value of ΔH if the equation is multiplied throughout by 2?

3. what is the value of ΔH if the reaction in question 2 is reversed so that the products become the reactants and vice versa?

4. Consider two metals A and B, each having a mass of 100 g and an initial temperature of 20°C. The specific heat of A is larger than that of B. Under the same heating conditions, which metal would take longer to reach a temperature of 21°C?

5. Calculate the heat of combustion for the following reaction from the standard enthalpies of formation using the standard enthalpies of formation found in appendix 3.
$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

6. From these data, $S(\text{rhombic}) + O_2(g) \rightarrow SO_2(g)$ $^0\Delta H_{rxn} = -296.06$ kJ/mol
$S(\text{monoclinic}) + O_2(g) \rightarrow SO_2(g)$ $\Delta Hrxn = -296.36$ kJ/mol

calculate the enthalpy change for the transformation
S(rhombic) → S(monoclinic)
(Monoclinic and rhombic are different allotropic forms of elemental sulfur.)

7. From the following data,
$C(\text{graphite}) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393.5$ kJ/mol
$H_2(g) + {}^{1}/_{2}\, O_2(g) \rightarrow H_2O(l)$ $\Delta H = -285.8$ kJ/mol
$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$ $\Delta H = -3119.6$ kJ/mol

calculate the enthalpy change for the reaction $2C(\text{graphite}) + 3H_2(g) \rightarrow C_2H_6(g)$

8. Note the following heats of combustion:

$CH_3OH(l) + {}^{3}/_{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ $^0{}_{rxn}\Delta H = -726.4$ kJ/mol
$C(\text{graphite}) + O_2(g) \rightarrow CO_2(g)$ $^0{}_{rxn}\Delta H = -393.5$ kJ/mol
$H_2(g) + {}^{12}\, O_2(g) \rightarrow H_2O(l)$ $^0{}_{rxn}\Delta H = -285.8$ kJ/mol

Calculate the enthalpy of formation of methanol (CH_3OH) from its elements:
$C(\text{graphite}) + 2H_2(g) + {}^{12}\, O_2(g) \rightarrow CH_3OH(l)$

9. A 44.0-g sample of an unknown metal at 99.0°C was placed in a constant-pressure calorimeter containing 80.0 g of water at 24.0°C. The final temperature of the system was found to be 28.4°C. Calculate the specific heat of the metal. (The heat capacity of the calorimeter is 12.4 J/°C.)

10. A piece of stainless steel of mass 25.0 g at 88.0°C was placed in a calorimeter that contained 150.0 g ofwater at 20.0°C. If the temperature of the water rose to 21.4°C, what is the specific heat capacity of thestainless steel? The specific heat capacity of water is 4.184 J/ g (°C).

11. A reaction occurs in a calorimeter that contains 120.0 g of water at 25.00°C, and 3.60 kJ of heat is evolved.If the specific heat capacity of water is 4.184 J/ g (°C), what is the final temperature of the water?

12. Calcium oxide and water react in an exothermic reaction:$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(s)$ $\Delta H°_{rxn} = -64.8$ kJHow much heat would be liberated when 7.15 g CaO(s) is dropped into a beaker containing 152 g H_2O?

13. What is the heat of solution in KJ/ mol of LiOH given that suzy took 10.00 g of LiOH and put it into 100.0 g of water in a bomb calorimeter. The specific heat of solution is 4.06 J/ g °C and the density of solution is 1.01 g/ mL and the temperature increases 2.32 °C.

14. Find the heat of neutralization in (KJ/ mol) when 300.0 mL of 0.200 M HNO_3 at 25.0 °C is mixed with 300.0 mL of 0.200 M of LiOH at 25.0 °C . The specific heat of solution is 4.06 J/ g °C and the density of solution is 1.01 g/ mL. The temperature of solution rises to 32.3 °C.

15. Anhydrous Ammonium Acetate can be used to make a cold pack what would be the heat of solution if 5.00 g of Ammonium Acetate placed in 100.0 g of water causes the temperature to drop 3.24 °C and the specific heat of solution and density of solution is the same as in problem 14.

Answers:

1. The part of the universe that is of interest to us. **2** –2905.6 kJ/ mol
3. 1452.8 kJ/ mol 4. metal A because of the definition of specific heat
5. –571.6 kJ/ mol 6. 0.30 kJ/ mol 7. –84.6 kJ/ mol
8. –238.7 kJ/mol 9. 0.492 J/g · °C 10. 0.53 J/ g (°C)
11. 32.17 °C 12. 8.26 kJ 13. – 2.513 KJ/ mol
14. –299 KJ/ mol 15. +21.4 KJ/ mol