South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

6 • Energy and Chemical Reactions

STUDY QUESTIONS

3. If the temperature of a 50.0-gram block of aluminum increases by 10.9 K when heated by 500 Joules, calculate the
   a. heat capacity of the aluminum block
   c. specific heat of aluminum

5. Calculate the heat necessary to change the temperature of one kg of iron from 25°C to 1000°C. The specific heat of iron is 0.451 $JK^{-1}g^{-1}$.

6. If a 40 gram block of copper at 100°C is added to 100 grams of water at 25°C, calculate the final temperature assuming no heat is lost to the surroundings. The specific heat of copper is 0.385 $JK^{-1}g^{-1}$ and the specific heat of water is 4.184 $JK^{-1}g^{-1}$.

7. Calculate the amount of heat needed to melt 27.0 g of ice if the heat of fusion of ice is 6.009 kJ/mol.

8. If 27.0 grams of ice at 0°C is added to 123 grams of water at 100°C in an insulated container, calculate the final temperature. Assume that the specific heat of water is 4.184 $JK^{-1}g^{-1}$.

9. A 50 gram block of an unknown metal alloy at 100°C is dropped into an insulated flask containing approximately 200 grams of ice. It was determined that 10.5 grams of the ice melted. What is the specific heat capacity of the unknown alloy?

10. If the enthalpy change for the combustion of propane is –2220 kJ/mole propane, what quantity of heat is released when 1 kg of propane is burned?
    $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$ ΔH-2220 kJ

11. Using the following thermochemical data, calculate the molar heat of **combustion**, $\Delta H°_{combustion}$ of methane, CH_4:
    $2CH_4(g) + 3O_2(g) \rightarrow 2CO(g) + 4H_2O(l)$ $\Delta H° = -1215$ kJ
    $2C(s) + O_2(g) \rightarrow 2CO(g)$ $\Delta H° = -221$ kJ
    $C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H° = -394$ kJ

12. Calculate the standard molar enthalpy of **formation** of methane from the data given in question 11, your answer to question 11, and the following: $\Delta H°_f$ ($H_2O(l)$) = -286 kJ/mol

13. When ammonia is oxidized to nitrogen dioxide and water, the quantity of heat released equals 349 kJ per mol of ammonia:
    $2NH_3(g) + {}^7/_2O_2(g) \rightarrow 2NO_2(g) + 3H_2O(l)$ $\Delta H° = -698$ kJ
    Calculate the standard molar enthalpy of formation of ammonia if
    $\Delta H°_f$ ($H_2O(l)$) = -286 kJ/mol
    $\Delta H°_f$ ($NO_2(g)$) = +33 kJ/mol

15. When 40 grams of ammonium nitrate is dissolved in 100 grams of water in a constant-pressure coffee-cup calorimeter, the temperature of the solution drops by 22.4°C. If the specific heat of the solution is 4.18 $JK^{-1}g^{-1}$, calculate the enthalpy of solution of ammonium nitrate.