Chem. 120 Review of Thermochemistry

1. Key terms

* calorie – the amount of heat required to raise 1 g of water 1 oC
* heat - A measure of the total energy in a system
* temperature - A measure of the average energy in a system; the average kinetic energy of molecules in motion
* potential energy (PE) – the stored energy that matter possesses owing to its position or composition
* kinetic energy - The energy associated with the motion of molecules
* Exothermic reaction - A reaction that evolves heat energy.
* Endothermic reaction - A reaction that absorbs heat energy.
* heat of reaction – the difference of energy between the reactants and the products
* Heat capacity (C) - the amount of heat (usually expressed in calories, kilocalories, or joules) needed to raise the system's temperature by one degree (usually expressed in Celsius or Kelvin)

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* Specific heat (c) - the amount of heat needed to raise the temperature of one gram of a substance by 1°C.

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1. Aluminum has a specific heat of 0.902 J/g·oC. How much heat is lost when a piece of aluminum with a mass of 23.984 g cools from a temperature of 415.0oC to a temperature of 22.0oC?

q = (23.984 g) x (0.902 J/g·oC) x (22.0 oC – 415.0oC)

q = - 8501.992224 J = - **8.50 x 103 J**

1. How much total heat (in kJ) is transferred when 52.7g of water decomposes as shown in the equation?

\_2\_\_ H2O*(l)* → \_2\_\_ H2*(g)* + \_\_\_ O2*(g)* ∆H = +572.1 kJ

52.7 g (1 mol / 18.016 g) (+572.1 kJ / 2 mol H2O) = **837 kJ**

1. Calculate how many Joules of energy are required to heat 180g of H2O from 50°C to 150°C Specific heat

H2O(*s*) = 2.09 J/g K H2O(*l*) = 4.18 J/g K H2O(*g*) = 1.84 J/g K

ΔHfus = 6.01 kJ/mol ΔHvap = 44.0 kJ/mol

180g H2O \* (1mole/18.0g) = 10.0 moles H2O

Heat needed to raise temp from 50 to 100°C:

ΔT = (100-50) = 50°C or 50K

Therefore, heat needed = (4.18J/g K)\*(180g)\*(50K) = 37,620J or 37.6kJ

Heat needed to vaporize 180g of H2O(*l*) to 180g of H2O(*g*):

(44.0kJ/mol) \* (10.0mole) = 440kJ

Heat needed to raise temp of 180g of steam from 100°C to 150°C:

ΔT = (150-100) = 50°C or 50K

Therefore, heat needed = (1.84J/g K)\*(180g)\*(50K) = 16,560J or 16.6kJ

Total energy: 37.6kJ + 440kJ + 16.6kJ = 494kJ or 494 x 103 J or 494,000 J