CHM151 Quiz 7b 25 Pts Fall 2005 Name: Key

SHOW ALL WORK.

1. (6 Pts) When 45.0 g of an alloy at 100.0 °C is dropped into 100.0 g of water at 25.0 °C, the final temperature is 37.0 °C. What is the specific heat of the alloy? (Specific Heat of Water = 4.18 J/g·K)

Sp Ht units: $\frac{J}{g^{\circ}C}$ so find each quantity

Assume Heat lost by Alloy = Heat gained by H_2O

For H_2O: $\frac{4.18\ J}{g\ K} \left| \frac{100.0\ g}{} \right| \frac{12.0\ K}{} = 5016\ J$ (ΔT_{H_2O})

for Alloy: $\frac{5016\ J}{} \left| \frac{}{45.0\ g} \right| \frac{}{63\ K} =$ (ΔT_{Alloy})

$\frac{1.77\ J}{g\ K}$

2. (6Pts) The heats of formation, ΔH_f^0 in are shown in the table. What is ΔH in kJ for the reaction

$$2C_2H_2 + 5O_{2(g)} \rightarrow 4CO_{2(g)} + 2H_2O_{(g)} \quad \Delta H = ?$$

Compound	ΔH_f^0 kJ/mole
$C_2H_{2(g)}$	+227
$H_2O_{(g)}$	–242
$CO_{2(g)}$	–393

$\Delta H_{RXN} = \sum n\Delta H_{products} - \sum n\Delta H_{Reactants}$

$= [4(-393) + 2(-242)] - [2(227) + 0]$

$-2052 - 454 = -2510\ kJ$

3. (7 Pts) What is the standard enthalpy of combustion of C_2H_6 in kJ·mol^{-1}?

GOAL ⇒ $C_2H_6(g) + 7/2O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)$

Thermochemical Data		
1.	$H_{2(g)} + {}^1/_2O_{2(g)} \rightarrow H_2O_{(l)}$	$\Delta H^0 = -286$ kJ
2.	$C_2H_{4(g)} + H_{2(g)} \rightarrow C_2H_{6(g)}$	$\Delta H^0 = -137$ kJ
3.	$C_2H_{4(g)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 2H_2O_{(l)}$	$\Delta H^0 = -1412$ kJ

C_2H_6 (g): reverse #2 $C_2H_6(g) \rightarrow C_2H_4(g) + H_2(g)$ ΔH: 137 kJ

$7/2\ O_2$ (g): skip (found in more than one equation)

$2\ CO_2$ (g): #3 as is $C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(l)$ -1412 kJ

$3\ H_2O$ (l): #1 as is (to get $3H_2O$) $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ -286 kJ

$C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ -1561 kJ

4. (6 Pts) Given the equation: $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)} \quad \Delta H = -200$ kJ

Calculate the value of ΔH when 45 grams of $SO_3(g)$ are formed. (molar masses S = 32.06, O = 16.00)

Conversion factor for $\Delta H = \frac{-200\ kJ}{2\ mol\ SO_3}$

$\frac{45\ g\ SO_3}{80.06\ g} \left| \frac{-200\ kJ}{2\ mol\ SO_3} \right. = -56.2\ kJ = \Delta H$