Thermochemistry (2)

#1 $T_f = 22.2°C$

$-q_{lost} = q_{gained}$

$-q_{Zn} = q_{H_2O} + q_{calorimeter}$

$-(65.45g)(0.388\ J/g\,C°)(-52.8\ C°) =$

$(125g)(4.184\ J/g\,C°)(2.3C°) + H_c(2.3C°)$

$1341\ J = 1203\ J + H_c(2.3C°)$

A) $H_c = 59.9\ J/C° = 60.\ J/C°$

$NH_4Cl_{(s)} \longrightarrow NH_4Cl_{(aq)}$

5.00g

$\frac{5.00g \mid 1\ mol}{\mid 53.5g} = 0.09346\ mol$

$-q_{rxn} = q_{soln} + q_{calorimeter}$

$-q_{rxn} = (155g\ soln)(4.18\ J/g\,C°)(-1.8\,C°) + (60.\ J/C°)(-1.8\,C°)$

$-q_{rxn} = {}^-1166\ J + {}^-108\ J = {}^-1274\ J$

B) $q_{rxn} = 1274\ J$

C) $\Delta H = \frac{1274\ J}{0.09346\ mol} = 13,600\ J/mol = 13.6\ kJ/Mol$

2 A 0.712-g sample of magnesium is burned in excess oxygen in a bomb calorimeter with a heat capacity of 722 J/C° containing 350.0 g of water initially at 21.57°C. The temperature of the apparatus rises to 26.32°C.

3 s.f.

$\frac{0.712 g\ Mg}{} \Big| \frac{1\ mol}{24.31 g} = 0.02929\ mol$

A) What is the enthalpy of combustion (in kJ/mol) of magnesium?

$-q_{rxn} = q_w + q_{calorimeter}$

$-q_{rxn} = M_w C_w \Delta T_w + H_c \Delta T_w$

$-q_{rxn} = (350.0 g)(4.184 J/gC°)(4.75C°) + (722 J/C°)(4.75C°)$

$-q_{rxn} = 10385 J = 10.385 kJ$

$q_{rxn} = -10.385 kJ$

$\Delta H = \frac{q_{rxn}}{mol\ reacting}$

$\Delta H = \frac{-10.385 kJ}{0.02929}$

$\Delta H = -355\ kJ/mol$

B) What is the heat of reaction in kJ for the balanced equation: $2 Mg_{(s)} + O_{2(g)} \rightarrow 2 MgO_{(s)}$

$= -355\ kJ/mol\ Mg \times 2\ mol\ Mg$ reacting

$\Delta H_{rxn} = -709\ kJ$

#3

$\frac{0.7000 L}{} \Big| \frac{0.500\ mol\ HCl}{1 L} = 0.350\ mol\ HCl \times \frac{1\ mol\ Ba(OH)_2}{2\ mol\ HCl} = 0.175$ mol $Ba(OH)_2$ needed

$\frac{0.3000 L}{} \Big| \frac{0.500\ mol}{1 L} = \boxed{0.150\ mol\ Ba(OH)_2}$

L.R.

$\boxed{1000\ mL\ soln = 1000\ g\ soln}$

$\frac{0.150\ mol\ Ba(OH)_2}{} \Big| \frac{-118\ kJ}{1\ mol\ Ba(OH)_2} = -17.7\ kJ$

A) (17,700 J produced) $q_{rxn} = -17,700 J$

$-q_{rxn} = q_{soln} + q_{calorimeter}$

$-q_{rxn} = m_{soln} C_{soln} \Delta T_{soln} + H_c \Delta T_{soln}$

$-(-17,700 J) = (1000 \cancel{g})(4.184 J/\cancel{g}C°)\Delta T + (180.3 J/C°)\Delta T$

$17700 J = (4364.3 \frac{J}{C°})\Delta T$

B) $\Delta T = 4.06\ C° = T_f - 25.0°C$

$\boxed{T_f = 25.0°C + 4.06°C = 29.1°C}$