Answers to Chapter 5 Review Questions Pg. 343

1. b 2. c 3. b 4. c 6. e 7. a 8. d 10. d

30.

(1) x-1 reverse $Ca(OH)_2(s) \rightarrow CaO(s) + H_2O(l)$ $\Delta H° = +65.2 kJ$

(2) x-1 reverse $CaO(s) + CO_2(g) \rightarrow CaCO_3(s)$ $\Delta H° = -178.1 kJ$

(3) x-1 reverse $Ca^{2}+ (aq) + 2OH^{-} (aq) \rightarrow Ca(OH)_2(s)$ $\Delta H° = +16.2 kJ$

$Ca^{2}+ (aq) + 2OH^{-} (aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$

$\Delta H° = 65.2 kJ – 178.1 kJ + 16.2 kJ = -96.7 kJ$

32. a. $Cu(NO_3)_2(s) + 302.9 kJ \rightarrow Cu(s) + N_2(g) + 3O_2(g)$

b. n Cu = 37.9 g x 1 mol/63.546 g = 0.596418 mol

Q = 302.9 kJ/mol x 0.0596418 mol = 180.655 kJ

The thermal energy required to produce the copper is 181 kJ.

33. The equation has been reversed and the sign of H°r should now be negative, as shown. The given value of H°r was for 1 mol of $N_2O_4(g)$. Since there is now 1/2 mol $N_2O_4(g)$, H°r must also be divided by 2. Therefore, the given equation is not correct. The correct equation is:
$NO_2(g) \rightarrow 1/2\ N_2O_4(g)$ H°r = -28.6 kJ

36. (1) × -2: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ $\Delta H° = -571.6 kJ$

(2) × 1: $C_3H_4(g) + 4O_2(g) \rightarrow 3CO_2(g) + 2H_2O(l)$ $\Delta H° = -1936.8 kJ$

(3) ×-1: $3CO_2(g) + 4H_2O(l) \rightarrow C_3H_8(g) + 5O_2(g)$ $\Delta H° = 2219.2 kJ$

$C_3H_4(g) + 2H_2(g) \rightarrow C_3H_8(g)$ $\Delta H°r = -289.2 kJ$

37. $\Delta H°r = [\Sigma(n\Delta H°f products)] - [\Sigma(n\Delta H°f reactants)]$

-159.6 kJ = [(1 mol)($\Delta H°f$ $Ni(CO)_4(g)$)] - [(1 mol)($\Delta H°f$ Ni) + (4 mol)($\Delta H°f$ CO(g))]

-159.6 kJ = [(1 mol)($\Delta H°f$ $Ni(CO)_4(g)$)] - [(1 mol)(0 kJ/mol) + (4 mol)(-110.5 kJ/mol)]

$\Delta H°f$ $Ni(CO)_4(g)$ = -159.6 kJ - 442.0 kJ = -601.6 kJ

The standard molar enthalpy of formation is -601.6 kJ/mol.

38. $\Delta H°r = [\Sigma(n\Delta H°f products)] - [\Sigma(n\Delta H°f reactants)]$

$= [(1\ mol)(\Delta H°f\ C_4H_6(g)) + (2\ mol)(\Delta H°f\ H_2O(g)) + (1\ mol)(\Delta H°f H_2\ (g))] - [(2\ mol)(\Delta H°f C_2H_5OH(l))$

$= [(1\ mol)(-391.1\ kJ/mol) + (2\ mol)(-241.8\ kJ/mol) + (1\ mol)(0\ kJ/mol)] - [(2\ mol)(-277.6\ kJ/mol)]$

$= -319.5\ kJ$

The standard enthalpy of reaction for the reaction as written is –319.5 kJ.