1) Which requires more energy: a) warming 100.0 mL of water from 20°C (room temperature) to 37°C (body temperature) or b) warming 50.0 mL of ethanol from 20°C to 37°C?

a) $q = mC\Delta T$ = 100 g(4.184J/g°C)(37-20°C)= 7112.8 J = ~ 7000 J
b) $q = mC\Delta T$ = 50 mL(0.789g/mL)(2.46J/ g°C)(37-20°C) = 1649 J = ~2000 J
a requires more energy

2) An unknown metal requires 561 J to heat a 32.4 g sample of it from 15.5°C to 34.7°C. What metal in Table 6.1 is the unknown?

$q = mC\Delta T$
561J = 32.4g(C)(34.7-15.5°C)
C = 0.902 J/g°C Al

3) How much energy (in kilojoules) would be required to raise the temperature of a cube of gold (1ft x 1ft x 1ft) from room temperature (25°C) to its melting point (1064°C) and then melt the gold completely at 1064°C? (the enthalpy of fusion of gold is 12.55 kJ/mole)

1 $ft^3(12^3 in^3/1 ft^3)(2.54^3 cm^3/1 in^3)(1 mL/cm^3)$(19.32g/mL) = 5.47×10^5g
Heating $q = mC\Delta T$ = 5.47×10^5g(0.128J/g°C)(1064-25°C) = 7.27×10^7J = 7.27×10^4kJ
Melting $q = mH_{fus}$ = 5.47×10^5g (12.55 kJ/mol)(1mol/196.9g) = 3.49×10^4kJ
Total = 7.27×10^4 J + 3.49×10^4 kJ = 1.076×10^5kJ = 1×10^5 kJ

4) Given the thermochemical equation

$CaO_{(s)} + 3\,C_{(s)} \rightarrow CaC_{2(s)} + CO_{(g)}$ ΔH^o = 464.8 kJ

What quantity of energy is transferred when:

a) 10.0 g of CO are formed?
10.0 gCO(1 mol CO/28gCO)(464.8 kJ/mol) = 1.66×10^2kJ
b) 18.4 moles of CaO are used? 8.55×10^3 kJ
c) 103.6 g of CaC_2 are made? 7.515×10^2 kJ

Chapter 6: 34, 36, 46, 52, 56, 70, 74, 76, 86, 92, 95, 102, 115, 126, 140

6.34

$q_{Cu} = -q_{H20}$
$mC\Delta T = -mC\Delta T$
192g(0.385J/g°C)(T_f-100°C) = -[750 g(4.184J/g°C)(T_f – 4.0°C)]
T_f = 6.21°C

6.36 a) $q = mC\Delta T$
2.38 J = 0.310g (C)(38.7-23.4)
C = 0.502 J/g°C
b) 0.502 J/g°C (12g/1 mol) = 6.02 J/mol°C
c) graphite 0.720 J/g°C You would expect the molar heat capacities of graphite and diamond to be the same since they are both materials made of carbon atoms. The molar heat

capacities are different because these two allotropes of carbon contain a different arrangement of carbon atoms creating materials with very different physical properties.

6.46 Melting $q = mH_{fus} = 240.4g(333J/g) = 8.01x10^4J$
Heating $q = mC\Delta T = 240.4g(4.184\ J/g^oC)(100-0^oC) = 1.01x10^5J$
Evaporation $q = mH_{vap} = 240.4g\ (2260J/g) = 5.43x10^5J$
Total = $7.24\ x10^5J$

6.52 a) $Y_{(s)}$ b) heat of vaporization; c) fusion is – (exothermic)

6.56 $NaCl_{(s)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)}$ $\Delta H > 0$ or (+)

6.70 10.0g Al(1molAl/26.98gAl)(-851.5 kJ/2molAl) = $-1.58x10^2$ kJ

6.74 I_2

6.76

$H_2 + Br_2 \rightarrow 2HBr$	$H_2 + I_2 \rightarrow 2HI$
a) 1 mol H-H (436 kJ/mol) = 435 kJ	a) 1 mol H-H (436 kJ/mol) = 436 kJ
1 mol Br-Br (129 kJ/mol) = 129 kJ	1 mol I-I (151 kJ/mol) = 151 kJ
629 kJl	587 kJ
b) 2 mol H-Br (366 kJ/mol)= 732 kJ	2 mol H-I (299 kJ/mol) = 598 kJ
c) -732 kJ + 629 kJ = -103 kJ	-598 kJ + 587 kJ = -11 kJ

d) Bromine reaction is more exothermic

6.86 $PbCl_{2(s)} \rightarrow Pb_{(s)} + Cl_{2(g)}$ +359.4 kJ
$Pb_{(s)} + 2Cl_{2(g)} \rightarrow PbCl_{4(l)}$ -329.3 kJ
1
$PbCl_{2(s)} + Cl_{2(g)} \rightarrow PbCl_{4(l)}$ 30.1 kJ

6.92 a) exothermic
b) $6C_{(s,graphite)} + 3\ O_{2(g)} + 3H_{2(g)} \rightarrow C_6H_{12}O_{6(s)}$ $\Delta H^o = -1274.4$ kJ/mol

6.95 $4NH_{3(g)} + 5O_{2(g)} \rightarrow 4\ NO_{(g)} + 6H_2O_{(g)}$
$\Delta H^o_{rxn} = \sum n\Delta H^o_{prod} - \sum n\Delta H^o_{reactants}$
= [(4mol $NO_{(g)}$)(90.25kJ/mol) + 6mol $H_2O_{(g)}$ (-241.818 kJ/mol)] + [4 mol $NH_{3(g)}$(-46.11kJ/mol) + 5mol O_2 (0 kJ/mol)]
= $-9.06x10^2$ kJ exothermic

6.102
Moles of air:
$1800ft^2(8.0ft)(12^3in^3/1ft^3)(2.54^3cm^3/in^3)(1mL/1cm^3)(1L/1000mL)(1.22g/1L)(1mol/28.9g)$
= $1.72\ x10^4$mol
$q = mC\Delta T = 1.72\ x10^{14}mol\ (29.1\ J/mol^oC)(22.0-15.0^oC) = 3.51\ x10^6J$

$CH_{4(g)} + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$
$\Delta H^o_{rxn} = \sum n\Delta H^o_{prod} - \sum n\Delta H^o_{reactants}$

$= [(1\text{mol } CO_{2(g)})(-393.509\text{kJ/mol}) + 2\text{mol } H_2O_{(g)} (-241.818\text{kJ/mol})]$
$\quad - [1 \text{ mol } CH_{4(g)} (-74.81\text{kJ/mol}) + 2\text{mol } O_2 (0 \text{ kJ/mol})]$
$= -8.02\times10^2\text{kJ}$

$-8.02\times10^2\text{kJ/mol } CH_4 \ (X \text{ mol } CH_4) = 3.51 \times10^6\text{J } (1 \text{ kJ}/1000\text{J})$
$X = 4.37 \text{ mol } CH_4 \ (16 \text{ g } CH_4 / 1 \text{ mol } CH_4)$
$= 69.95 \text{ g } CH_4 = 7.0 \times10^1 \text{g } CH_4$

6.115 $2C_{(s,graphite)} + 2H_{2(g)} \rightarrow C_2H_{4(g)} \quad \Delta H = 52.3 \text{ kJ}$
$C_2H_{4(g)} + Cl_{2(g)} \rightarrow C_2H_4Cl_{2\,(l)} \quad \Delta H = -217.5 \text{ kJ}$
$2C_{(s,graphite)} + 2H_{2(g)} + Cl_{2(g)} \rightarrow C_2H_4Cl_{2\,(l)} \quad \Delta H = -165.2 \text{ kJ}$

6.126 Substance A

6.140 a) exothermic
b) in exp 3 & 4 same heat transferred; all Drano is used up when at least 3Tbs of the Works is added; in exp 4, 1 Tbsp extra of the works was added
c) exp 1 Works
exp 2 Works
exp 3 neither
exp 4 Drano
d) see answer for b
e) $Drano_{tsp}Works_{3Tbsp}$