Ch. 6 Problems # ~~11, 18, 23, 25, 27, 38, 40, 42, 46, 50, 55, 57, 60,~~
~~61, 67, 68, 70, 73, 78, 79, 80, 82, 87, 92, 99~~

(11) $\Delta E = ?$

$q = (+)\ 0.615\,kJ \times \frac{1000\,J}{1\,kJ} = 615\,J$

$w = (+)\ 0.247\,kcal \times \frac{1000\,cal}{1\,kcal} \times \frac{4.184\,J}{1\,cal} = 1033.448\,J$

$\Delta E = 615 + 1033.448 = 1648.45\,J = \boxed{1.65 \times 10^3\,J}$

(18) $\boxed{\Delta H = (-)\ \text{exothermic reaction}}$

(23) external pressure $= 2660\,mmHg \times \frac{1\,atm}{760\,mmHg} = 3.5\,atm$

$V_i = 0.88\,L$

$V_f = 0.63\,L$

$w = kJ\,?$

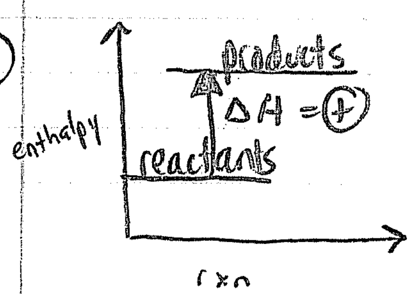
$w = -P\Delta V$

$= -3.5(-0.25)$

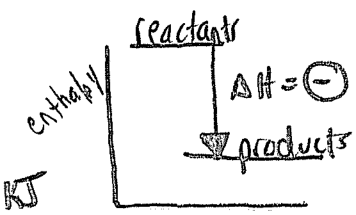
$= 0.875\,atm \cdot L \times \frac{101.3\,J}{1\,atm \cdot L} = 88.6\,J \times \frac{1\,kJ}{1000\,J}$

$\boxed{= 0.089\,kJ}$

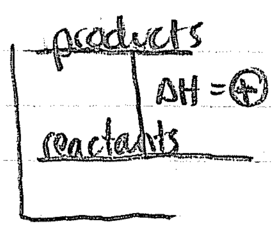
(25)



endothermic reaction



(27) (a) $Na_{(s)} + \frac{1}{2}Cl_{2(g)} \rightarrow NaCl_{(s)}$ $\Delta H = -411.1\,kJ$



(b) $C_6H_{6(l)} \rightarrow C_6H_{6(g)}$ $\Delta H = (+)$

(38) $q = ?$ all ice so $c = 2.087\ J/gK$

$m = 0.10g$ $q = 2.087(0.10)(-75-10)$

$T_i = 10°C$ $q = -17.74J$ of energy lost to cool ice down

$T_f = -75°C$ $\boxed{= -18J \text{ w/ sig figs}}$

(40) $m = 27.7g$

$q = -688J$ $q = c(m)(\Delta T)$

$T_i = ?$ $-688 = 2.42(27.7)(32.5 - T_i)$

$T_f = 32.5°C$ $-10.26 = 32.5 - T_i$

$c = 2.42\ J/g\cdot K$ $42.76 = T_i$ $\boxed{T_i = 42.8°C \text{ w/ sig figs}}$

(42)

Piece #1	Piece #2
$m = 20g$	$m = 10g$
$c = 0.387$	$c = 0.387$
$T_i = 105°C$	$T_i = 45°C$
$T_f =$	$T_f =$

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

$$-20(0.387)(x-105) = 10(0.387)(x-45)$$

$$-7.74x + 812.7 = 3.87x - 174.15$$

$$986.85 = 11.61(x)$$

$$x = 85°C$$

(46) $m = 30.5g$ alloy $m_{H_2O} = 50.0g$

$T_i = 93°C$ $T_i = 22°C$

$T_f = 31.1°C$ $C_{cal} = 9.2\ J/K$

$c = ?$ $T_f = 31.1°C$

heat lost by alloy is gained by calorimeter & by water in calorimeter

$$-q_{alloy} = q_{H_2O} + q_{cal}$$

$$c(30.5)(31.1-93) = [4.184(50)(31.1-22)] + [9.2(31.1-22)]$$

$$\boxed{c = -1.1\ J/g°C}$$

(50) $\underline{H_2SO_4}$ $\underline{KOH}$

25mL 25.0mL $T_i = 23.50°C$

0.500M H_2SO_4 1.0M $T_f = 30.17°C$

$$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2HOH$$

$q = {}^{-}4.184(50)(30.17 - 23.50)$

$\boxed{q = {}^{-}1395.364J} = \boxed{{}^{-}1.395 kJ}$

Limiting

$$0.025L \times \frac{0.50mol}{1L} \times \frac{1mol\ K_2SO_4}{1mol\ H_2SO_4} = 0.0125mol\ K_2SO_4$$

$$0.025L \times \frac{1.0mol}{1L} \times \frac{1mol\ K_2SO_4}{2mol\ KOH} = 0.0125mol\ K_2SO_4$$

so $\Delta H = \frac{1.395KJ}{0.0125mol} = {}^{-}111.6 kJ/mol\ H_2SO_4$

or

${}^{-}55.81$ kJ/Mol KOH

(55) $MgCO_{3(s)} \rightarrow MgO_{(s)} + CO_{2(g)}$ $\Delta H = 117.3 kJ$

(a) absorbed $\Delta H = (+)$

(b) $\Delta H = -117.3 kJ$

(c) $5.35 mol\ CO_2 \times \frac{-117.3KJ}{1mol\ CO_2} = \boxed{-628 KJ}$

(d) $35.5g\ CO_2 \times \frac{1mol\ CO_2}{44.01g} \times \frac{-117.3KJ}{1mol\ CO_2} = \boxed{-94.6KJ}$

(57) $KBr_{(s)} \rightarrow K_{(s)} + \frac{1}{2}Br_{2(l)}$ $\Delta H = 394\ kJ$

or

$2KBr_{(s)} \rightarrow 2K_{(s)} + Br_{2(l)}$ $\Delta H = 788\ kJ$

reverse rxn → forming KBr

$10000g\ KBr \times \frac{1\ mol\ KBr}{119\ g\ KBr} \times \frac{788\ kJ}{2\ mol\ KBr} = \boxed{-3.31 \times 10^4\ kJ}$

(60) $4Fe + 3O_2 \rightarrow 2Fe_2O_3$ $\Delta H = -1.65 \times 10^3\ kJ$

(a) $0.250\ kg \times \frac{1000g}{1\ kg} \times \frac{1\ mol\ Fe}{55.85\ g} \times \frac{-1.65 \times 10^3\ kJ}{4\ mol\ Fe_2O_3} = -1846.46\ kJ$ $\boxed{-1850\ kJ}$ sig figs

(b) $-4.85 \times 10^3\ kJ \times \frac{2\ mol\ Fe_2O_3}{-1.65 \times 10^3\ kJ} \times \frac{159.7g}{1\ mol\ Fe_2O_3} = 938.8g\ Fe_2O_3 = \boxed{939g\ Fe_2O_3}$

(61) $2HgO_{(s)} \rightarrow 2Hg + O_2$ $\Delta H = 181.6\ kJ$

(a) $555g \times \frac{1\ mol}{216.6\ g} \times \frac{181.6\ kJ}{2\ mol\ HgO} = 232.7\ kJ = \boxed{233\ kJ}$

(b) $275\ kJ \times \frac{2\ mol\ Hg}{181.6\ kJ} \times \frac{200.6g\ Hg}{1\ mol\ Hg} = \boxed{608\ g\ Hg}$

(67) $Ca + \frac{1}{2}O_2 + CO_2 \rightarrow CaCO_3$

$\boxed{Ca + \frac{1}{2}O_2} \rightarrow \cancel{CaO}$ $\Delta H = -635.1\ kJ$

$\cancel{CaO} + \boxed{CO_2} \rightarrow \boxed{CaCO_3}$ $\Delta H = -178.3\ kJ$

$\boxed{\Delta H_{rxn} = -813.4\ kJ}$

(68) $2\ NOCl \rightarrow N_2 + O_2 + Cl_2$

$\cancel{2\ NO} \rightarrow \boxed{N_2 + O_2}$ $\quad \Delta H = (-90.3)\,2$

$\boxed{2\ NOCl} \rightarrow \cancel{2\ NO} + \boxed{Cl_2}$ $\quad \Delta H = (38.6)\,2$

$\boxed{\Delta H = -103.4\ kJ}$

(70) ① $P_4 + 6\,Cl_2 \rightarrow 4\,\cancel{PCl_3}$ $\quad \Delta H = -1148\ kJ$ (B)

② $\cancel{4\,PCl_3} + 4\,Cl_2 \rightarrow 4\,PCl_5$ $\quad \Delta H = -460\ kJ$ (C)

$P_4 + 10\,Cl_2 \rightarrow 4\,PCl_5$ $\quad \Delta H = -1608\ kJ$ (A)

(73) $C_{diam} \rightarrow C_{graph}$ $\quad \Delta H = ?$

$C_{dia} + \cancel{O_2} \rightarrow \cancel{CO_2}$ $\quad \Delta H = -395.4\ kJ$

$\cancel{CO_2} \rightarrow C_{graph} + \cancel{O_2}$ $\quad \Delta H = +393.5\ kJ$

$\boxed{\Delta H = -1.9\ kJ}$

(78) (a) $\frac{1}{2} H_{2(g)} + \frac{1}{2} I_{2(s)} \rightarrow HI_{(g)}$ $\quad \Delta H = 25.9\ kJ$

(b) $Si_{(s)} + 2F_{2(g)} \rightarrow SiF_{4(g)}$ $\quad \Delta H = -1614.9\ kJ$

(c) $\frac{3}{2} O_{2(g)} \rightarrow O_{3(g)}$ $\quad \Delta H = 143\ kJ$

(d) $3\,Ca_{(s)} + \frac{1}{2} P_{4(s)} + 4O_{2(g)} \rightarrow Ca_3(PO_4)_2$ $\quad \Delta H = -4138\ kJ$

(79) (a) $\underset{-20.2}{2\,H_2S_{(g)}} + \underset{0}{3\,O_{2(g)}} \rightarrow \underset{-296.8}{2\,SO_{2(g)}} + \underset{-241.826}{2\,H_2O_{(g)}}$

$\Delta H = [2(-241.826) + 2(-296.8)] - [2(-20.2)] = \boxed{-1036.85\ kJ}$

(b) $\underset{-74.87}{CH_{4(g)}} + \underset{0}{4Cl_{2(g)}} \rightarrow \underset{-96}{CCl_{4(l)}} + \underset{-92.31}{4HCl_{(g)}}$

$\Delta H = [-139 + 4(-92.31)] - [-74.87] = \boxed{-433\ kJ}$

(80) (a) $SiO_{2(s)} + 4HF_{(g)} \rightarrow SiF_{4(g)} + 2H_2O_{(l)}$

-910.9   -273   -1614.9   -285.84

$\Delta H = [-1614.9 + (2)(-285.84)] - [-910.9 + 4(-273)] = \boxed{-184\,kJ}$

(b) $2C_2H_{6(g)} + 7O_{2(g)} \rightarrow 4CO_{2(g)} + 6H_2O_{(g)}$

-84.667   0   -393.5   -241.826

$\Delta H = [4(-393.5) + 6(-241.826)] - [2(-84.667)] = \boxed{-2855.62\,kJ \text{ for } 2\,mol\ C_2H_6}$

(82) $C_2H_{2(g)} + \frac{5}{2}O_{2(g)} \rightarrow 2CO_{2(g)} + H_2O_{(g)}$ $\Delta H = -1255.8\,kJ$

?   0   -393.5   -241.8 kJ

$-1255.8 = [2(-393.5) + (-241.8)] - X$

$-1255.8 = -1028.8 - X$

$\boxed{X = 227\,kJ/mol}$

(87) $C_6H_{12}O_{6(s)} \xrightarrow{yeast} 2CH_3CH_2OH_{(l)} + 2CO_{2(g)}$ $\Delta H =$ fermentation

makes liquid alcohol

-1273.3   -277.63   -393.5

$\Delta H = [2(-393.5) + 2(-277.63)] - [-1273.3] = \boxed{-68.96\,kJ}$

cellular respiration of sugar

$C_6H_{12}O_{6(s)} + 6O_{2(g)} \rightarrow 6H_2O_{(g)} + 6CO_{2(g)}$

-1273.3   ∅   -241.826   -393.5

$\Delta H = [6(-393.5) + 6(-241.826)] - [-1273.3]$

$\boxed{\Delta H = -2538.7\,kJ} / 6\,mol\,C = \boxed{-423.1\,kJ/mol\,C}$

* you will not have to derive bio equations on test

combustion of ethanol

$CH_3CH_2OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(g)}$

-277.63   0   -393.5   -241.826

$\Delta H = [2(-393.5) + 3(-241.826)] - [-277.63]$

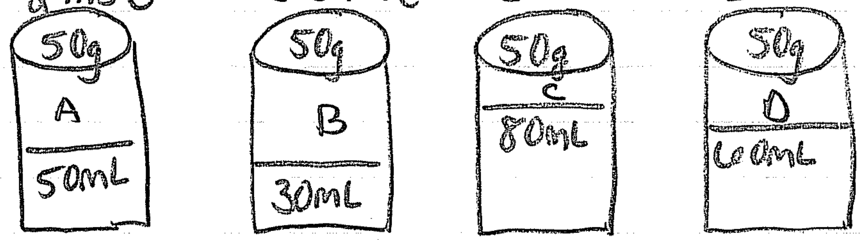
$\boxed{\Delta H = -1234.8\,kJ} / 2\,mol\,C = \boxed{-617.4\,kJ/mol\,C}$

(c) ethanol releases more heat per mol of C

(92)

$T_i = 25°C$ $\quad = 25°C$ $\quad = 25°C$ $\quad = 25°C$

$T_f = 27.15°C$ $\quad = 35.59°C$ $\quad = 28.96°C$ $\quad = 30.29°C$



$q = 450J$ $\quad q = 450J$ $\quad q = 450J$ $\quad q = 450J$

$\Delta T = 2.15°C$ $\quad \Delta T = 10.59°C$ $\quad \Delta T = 3.96°C$ $\quad \Delta T = 5.29°C$

$\boxed{B < D < C < A}$

smallest ΔT = largest capacity to hold heat

(99) $2C_{12}H_{26(l)} + 37O_{2(g)} \rightarrow 24CO_{2(g)} + 26H_2O_{(g)}$ $\quad \Delta H = -1.50\times10^4 KJ$

$0 \qquad -393.5 \qquad -241.826$

(b) $\Delta H_f^\circ = ?$

$-1.50\times10^4 = [24(-393.5) + 26(-241.826)] - 2x$

$731.48 = -2x$

$\boxed{x = -365.7 KJ}$

(c) $0.50gal \times \frac{3.785L}{1gal} \times \frac{1000mL}{1L} \times \frac{0.749g}{1mL} \times \frac{1\ mol}{170.33\ g} \times \frac{-1.50\times10^4 KJ}{2mol\ C_{12}H_{26}} = \boxed{-6.24\times10^4 J}$

released

(d) $1250BTU \times \frac{1.055KJ}{1Btu} \times \frac{2mol\,C_{12}H_{26}}{1.50\times10^4 KJ} \times \frac{170.33g}{1mol} \times \frac{1mL}{0.749g} \times \frac{1L}{1000mL} \times \frac{1gal}{3.785L} =$

$\boxed{0.011 \text{ gal needed}}$