53 - Heat Calculations

1. $v = 1.25 L$
   $\Delta T = 76.0°C$

   $q = vC\Delta T$

   $q = (1.25 L)(4.19 \frac{kJ}{L \cdot °C})(76.0°C)$

   $q = 398 kJ$

2. $v = 2.00 L$
   $\Delta T = -12.0°C$
   $q = ?$

   $q = vC\Delta T$

   $q = (2.00 L)(4.19 \frac{kJ}{L \cdot °C})(-12.0°C)$

   $q = -101 kJ$

3. $m = ?$
   $q = 1.00 MJ$
   $\Delta T = 80.0°C$

   $q = mC\Delta T$

   $m = \frac{1000\,000 J}{(0.900 \frac{J}{g \cdot °C})(80.0°C)}$

   $m = 13\,900 g$

4. $C = 3.88 \frac{kJ}{L \cdot °C}$
   $v = ?$
   $q = 1.00 MJ$
   $\Delta T = 80.0°C$

   $q = vC\Delta T$

   $v = \frac{1000 kJ}{(3.88 \frac{kJ}{L \cdot °C})(80.0°C)}$

   $v = 3.22 L$

5. $q = 2.00 kJ$
   $m = 100. g$
   $\Delta T = 5.97°C$
   $c = ?$

   $q = mC\Delta T$

   $C = \frac{2000 J}{(100. g)(5.97°C)}$

   $C = 3.35 \frac{J}{g \cdot °C}$

6. $q = -360 kJ$
   $m = 60. kg$
   $\Delta T =$

   $q = mC\Delta T$

   $\Delta T = \frac{-360\,000 J}{(60\,000 g)(4.19 \frac{J}{g \cdot °C})}$

   $\Delta T = -1.43°C$

54- Enthalpy Changes

1 a) phase - same substance, different state
chemical - new bonds, substance formed
nuclear - change in nucleus, new element formed

b) All involve rearrangement of particles.

2. $m = 30.g$

$\Delta H_{fus} = nH_{fus}$

$\Delta H_{fus} = \left(\frac{30.g}{18.02 g/mol}\right)\left(6.01 \frac{kJ}{mol}\right)$

$\boxed{\Delta H_{fus} = 10. kJ}$

3. $m = 10.0g$
$H_{vap} = 39.23 kJ/mol$

$\Delta H_{vap} = nH_{vap}$

$\Delta H_{vap} = \left(\frac{10.0g}{32.05 g/mol}\right)\left(\frac{39.23 kJ}{mol}\right)$

$\boxed{\Delta H_{vap} = 12.2 kJ}$

4. $m = ?$
$H_{vap} = -1.37 kJ/mol$
$\Delta H_{vap} = -10.0kJ$

$\Delta H_{vap} = nH_{vap}$

$n = \frac{-10.0kJ}{-1.37 kJ/mol}$

$n = 7.299 mol$

$7.299 mol NH_3 \times \frac{17.04g NH_3}{1 mol NH_3}$

$= \boxed{124g NH_3}$

5. $m = 4.00g$
$\Delta H_{vap} = 1.67 kJ$
$H_{vap} = ?$

$\Delta H_{vap} = nH_{vap}$

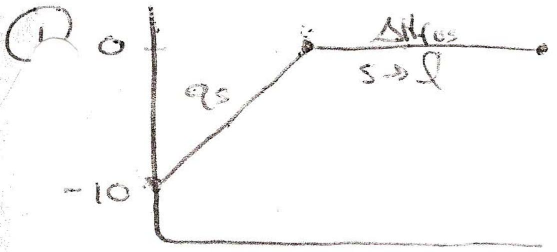
$H_{vap} = \frac{\Delta H_{vap}}{n}$

$H_{vap} = \frac{1.67 kJ}{\left(\frac{4.00 g}{58.14 g/mol}\right)}$

$\boxed{H_{vap} = 24.3 kJ/mol}$

Worksheet 55 - Total Energy Changes

1



$q_s = mc\Delta t$

$q_s = (3600g)(2.01 \frac{J}{g°C})(10°C)$

$q_s = 72\,360 J$

$\Delta H_{fus} = n H_{fus}$

$\Delta H_{fus} = \left(\frac{3600g}{18.02 g/mol}\right)(6.03 \frac{kJ}{mol})$

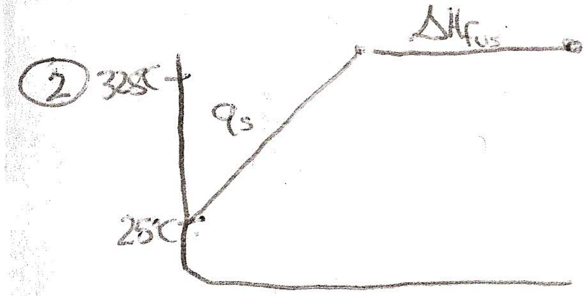
$\Delta H_{fus} = 1204.66 kJ$

$\Delta E_T = q_s + \Delta H_{fus}$

$\Delta E_T = (72.36 kJ) + (1204.66 kJ)$

$\Delta E_T = 1280 kJ$

2



$q_s = mc\Delta t$

$q_s = (100g)(0.159 \frac{J}{g°C})(303°C)$

$q_s = 4817.7 J$

$\Delta H_{fus} = n H_{fus}$

$\Delta H_{fus} = \left(\frac{100 g}{207.20 g/mol}\right)(5.0 \frac{kJ}{mol})$

$\Delta H_{fus} = 2.413 kJ$

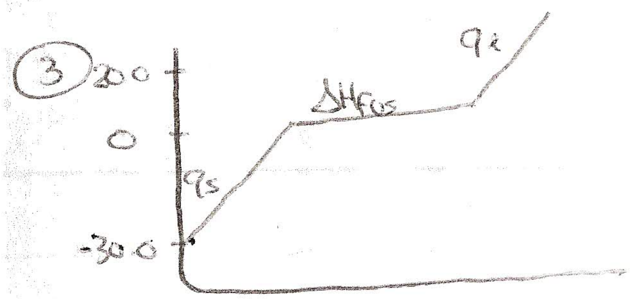
$\Delta E_T = q_s + \Delta H_{fus}$

$\Delta E_T = (4818 J) + (2413 J)$

$\Delta E_T = 7231 J$

$\Delta E_T = 7000 J$

3



$q_s = mc\Delta t$

$q_s = (1000g)(2.01 \frac{J}{g°C})(30.0°C)$

$q_s = 60\,300 J$

$\Delta H_{fus} = n H_{fus}$

$\Delta H_{fus} = \left(\frac{1000g}{18.02 g/mol}\right)(6.03 \frac{kJ}{mol})$

$\Delta H_{fus} = 334.628 kJ$

$q_l = mc\Delta t$

$q_l = (1000g)(4.19 \frac{J}{g°C})(20.0°C)$

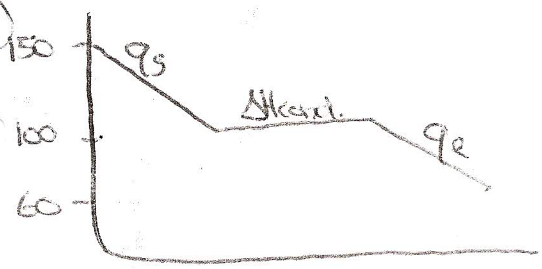
$q_l = 83\,800 J$

$\Delta E_T = q_s + \Delta H_{fus} + q_l$

$\Delta E_T = (60.300 kJ) + (334.628 kJ) + (83.800 kJ)$

$\Delta E_T = 479 kJ$

④



$q_g = mc\Delta t$

$q_g = (100\,000g)(2.01 \frac{J}{g \cdot °C})(50.0°C)$

$q_g = -10\,050\,000 J$

$\Delta H_{cond} = n H_{cond}$

$\Delta H_{cond} = \left(\frac{100\,000g}{18.02 g/mol}\right)\left(-40.8 \frac{kJ}{mol}\right)$

$\Delta H_{cond} = -226\,415 kJ$

$q_\ell = mc\Delta t$

$q_\ell = (100\,000g)(4.19 \frac{J}{g \cdot °C})(-40.0°C)$

$q_\ell = -16\,760\,000 J$

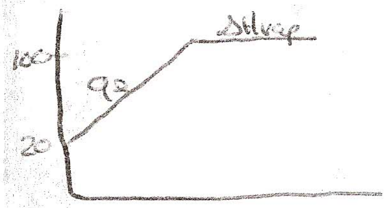
$\Delta E_T = q_g + \Delta H_{cond} + q_\ell$

$\Delta E_T = (-10\,050 kJ) + (-226\,415 kJ) + (-16\,760 kJ)$

$\Delta E_T = -253\,225 kJ$

$\Delta E_T = -253\,000 kJ$

① WATER



$q_\ell = mc\Delta t$

$q_\ell = (200\,000g)(4.19 \frac{J}{g \cdot °C})(80.0°C)$

$q_\ell = 67\,040\,000 J$

$\Delta H_{vap} = \left(\frac{200\,000g}{18.02 g/mol}\right)\left(40.8 \frac{kJ}{mol}\right)$

$\Delta H_{vap} = 452\,830.19 kJ$

$q_{steel} = mc\Delta t$

$q_{steel} = (500\,000g)(0.528 \frac{J}{g \cdot °C})(80.0°C)$

$q_{steel} = 21\,120\,000 J$

$\Delta E_T = \underbrace{q_\ell + \Delta H_{vap}}_{water} + q_{steel}$

$\Delta E_T = (67\,040 kJ) + (452\,830 kJ) + (21\,120 kJ)$

$\Delta E_T = 540\,990 kJ$

$\Delta E_T = 541\,000 kJ$

56 - CALORIMETRY

*1. Omit

*2. $C = 40.00\ kJ/°C$

$m = 1.00\ g\ H_2$

$\Delta T = 3.54\ °C$

$H_c = ?$

$\Delta H_c = -q$

$nH_c = -C\Delta T$ ← Different! (Bomb Calorimetry)

$$H_c = \frac{-(40.00\ kJ/°C)(3.54\ °C)}{\left(\frac{1.00\ g}{2.02\ g/mol}\right)}$$

$H_c = -286\ kJ/mol$

*3. $H_c = -803\ kJ/mol$

$V = 4.00\ L$

$\Delta T = 65.2\ °C$

$m = ?$

$\Delta H_c = -q$

$nH_c = -VC\Delta T$

$$n = \frac{-(4.00\ L)(4.19\ \frac{kJ}{L \cdot °C})(65.2\ °C)}{-803\ kJ/mol}$$

$n = 1.3608\ mol$

$$1.3608\ mol\ CH_4 \times \frac{16.05\ g\ CH_4}{1\ mol\ CH_4} = 21.8\ g\ CH_4$$

$21.8\ g\ CH_4$

*4. $m = 3.50\ g\ C_2H_5OH$

$C = 15.2\ kJ/°C$

$\Delta T = 6.30\ °C$

$H_c = ?$

$\Delta H_c = -q$

$nH_c = -C\Delta T$ ← see # 2!

$$H_c = \frac{-(15.2\ kJ/°C)(6.30\ °C)}{\left(\frac{3.50\ g}{46.08\ g/mol}\right)}$$

$H_c = -1260\ kJ/mol$

*5. $H_c = -1290\ kJ/mol$

$m = 1.00\ g\ C_2H_2$

$V = 1.00\ L$

$\Delta T = ?$

$\Delta H_c = -q$

$nH_c = -VC\Delta T$

$$\Delta T = \frac{\left(\frac{1.00\ g}{26.04\ g/mol}\right)\left(-1290\ \frac{kJ}{mol}\right)}{(1.00\ L)\left(4.19\ \frac{kJ}{L \cdot °C}\right)}$$

$\Delta T = 11.8\ °C$

57 - Communicating Enthalpy Changes

1. a) $4FeS_{(s)} + 7O_{2(g)} \rightarrow 2Fe_2O_{3(s)} + 4SO_{2(g)} + 2456\ kJ$

   b) $H_r = \frac{\Delta H_r}{n} = \frac{-2456\ kJ}{4\ mol} = \boxed{-614\ kJ/mol}$

   c) $H_r = \frac{\Delta H_r}{n} = \frac{-2456\ kJ}{2\ mol} = \boxed{-1228\ kJ/mol}$

2. a) $2B_{(s)} + 3H_{2(g)} \rightarrow B_2H_{6(g)}$ $\quad \Delta H_r = 31.4\ kJ$

   $\Delta H_r = nH_r$
   $\Delta H_r = (2\ mol)(15.7\ kJ/mol)$
   $\Delta H_r = 31.4\ kJ$

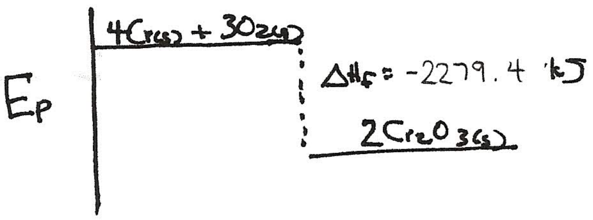
   b) $2B_{(s)} + 3H_{2(g)} + 31.4\ kJ \rightarrow B_2H_{6(g)}$

3. a) $2C_8H_{18(l)} + 25O_{2(g)} \rightarrow 16CO_{2(g)} + 18H_2O_{(g)}$ $\quad \Delta H_r = -2.6\ MJ$

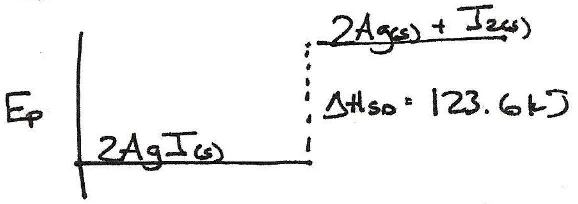
   $\Delta H_r = nH_r$
   $\Delta H_r = (2\ mol)(-1.3\ MJ/mol)$
   $\Delta H_r = -2.6\ MJ$

   b) $2C_8H_{18(l)} + 25O_{2(g)} \rightarrow 16CO_{2(g)} + 18H_2O_{(g)} + 2.6\ MJ$

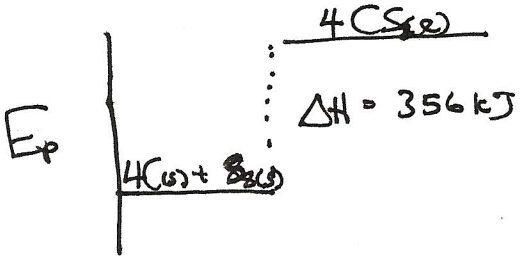
4. a) Formation of Cr_2O_3



b) Decomposition of AgI



c) Formation of $CS_{2(g)}$



a) $\Delta H_f = nH_f$
$\Delta H_f = (2\ mol)(-1139.7\ kJ/mol)$
$\Delta H_f = -2279.4\ kJ$

b) $\Delta H_{so} = nH_{so}$
$\Delta H_{so} = (2\ mol)(+61.8\ kJ/mol)$
$\Delta H_{so} = 123.6\ kJ$

c) $\Delta H_f = nH_f$
$\Delta H_f = (4\ mol)(89.0\ kJ/mol)$
$\Delta H_f = 356\ kJ$

58 - Predicting ΔHr Using Hess's Law

*1. Rev ①

③ $WBr_{4(s)} \rightarrow W_{(s)} + 2Br_{2(l)}$ — $\Delta H_r = 146.7\,kJ$

② $W_{(s)} + 3Br_{2(l)} \rightarrow WBr_{6(s)}$ — $\Delta H_r = -184.4\,kJ$

③ + ②

$Br_{2(l)} + WBr_{4(s)} \rightarrow WBr_{6(s)}$ — **$\Delta H_r = -37.7\,kJ$**

*2. Rev ①

③ $2NO_{2(g)} \rightarrow N_2O_{4(g)}$ — $\Delta H_r = -58\,kJ$

② × 2

④ $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ — $\Delta H_r = -112\,kJ$

③ + ④

$2NO_{(g)} + O_{2(g)} \rightarrow N_2O_{4(g)}$ — **$\Delta H_r = -170\,kJ$**

*3. Rev ① × 2

④ $2NO_{2(g)} \rightarrow N_{2(g)} + 2O_{2(g)}$ — $\Delta H_f = -66.4\,kJ$

Rev ② × 2

⑤ $2H_2O_{(g)} \rightarrow 2H_{2(g)} + O_{2(g)}$ — $\Delta H_f = 483.6\,kJ$

③ $N_{2(g)} + 2H_{2(g)} \rightarrow N_2H_{4(g)}$ — $\Delta H_r^\circ = 47.6\,kJ$

③ + ④ + ⑤

$2NO_{2(g)} + 2H_2O_{(g)} \rightarrow 3O_{2(g)} + N_2H_{4(g)}$ — **$\Delta H_r = 464.8\,kJ$**

4. ① × 14

④ $14C_{(s)} + 14O_{2(g)} \rightarrow 14CO_{2(g)}$ $\Delta H_r = -5509\ kJ$

② × 14

⑤ $14H_{2(g)} + 7O_{2(g)} \rightarrow 14H_2O_{(g)}$ $\Delta H = -3385.2\ kJ$

Rev ③ × 2

⑥ $2C_7H_{14(l)} \rightarrow 14C_{(s)} + 14H_{2(g)}$ $\Delta H_r = -230\ kJ$

④ + ⑤ + ⑥

$2C_7H_{14(l)} + 21O_{2(g)} \rightarrow 14CO_{2(g)} + 14H_2O_{(g)}$ $\boxed{\Delta H_r = -9124.2\ kJ}$

59 - Predicting $\Delta H_r°$ Using Standard Molar Enthalpies of Formation

1\. $C_2H_5OH_{(l)} \rightarrow C_2H_{4(g)} + H_2O_{(l)}$

$\Delta H_r = \Sigma nH_{fp} - \Sigma nH_{fr}$

$\Delta H_r = [(1\ mol)(52.5\ \frac{kJ}{mol}) + (1\ mol)(-285.8\ \frac{kJ}{mol})] - [(1\ mol)(-235.2\ \frac{kJ}{mol})]$

$\Delta H_r = 1.9\ kJ$

2\. $CH_3COOH_{(l)} + 2O_{2(g)} \rightarrow 2CO_{2(g)} + 2H_2O_{(g)}$

$\Delta H_r = \Sigma nH_{fp} - \Sigma nH_{fr}$

$\Delta H_r = [(2\ mol)(-393.5\ \frac{kJ}{mol}) + (2\ mol)(-241.8\ \frac{kJ}{mol})] - [(1\ mol)(-432.8\ \frac{kJ}{mol}) + (2\ mol)(0)]$

$\Delta H_r = -837.8\ kJ$

$H_r = \frac{\Delta H_r}{n} = \frac{-837.8\ kJ}{1\ mol} =$ **$-837.8\ kJ/mol$**

3\. $3Fe_2O_{3(s)} + CO_{(g)} \rightarrow 2Fe_3O_{4(s)} + CO_{2(g)}$

$\Delta H_r = \Sigma nH_{fp} - \Sigma nH_{fr}$

$\Delta H_r = [(2\ mol)(-1118.4\ \frac{kJ}{mol}) + (1\ mol)(-393.5\ \frac{kJ}{mol})] - [(3\ mol)(-824.2\ \frac{kJ}{mol}) + (1\ mol)(-110.5\ \frac{kJ}{mol})$

$\Delta H_r = -47.2\ kJ$

$H_r = \frac{\Delta H_r}{n} = \frac{-47.2\ kJ}{3\ mol} =$ **$-15.7\ kJ/mol$**

4\. $2NH_{3(g)} + CO_{2(g)} \rightarrow CO(NH_2)_{2(s)} + H_2O_{(l)}$

$\Delta H_r = \Sigma nH_{fp} - \Sigma nH_{fr}$

$\Delta H_r = [(1\ mol)(-333.5\ \frac{kJ}{mol}) + (1\ mol)(-285.8\ \frac{kJ}{mol})] - [(2\ mol)(-45.9\ \frac{kJ}{mol}) + (1\ mol)(-393.5\ \frac{kJ}{mol})]$

$\Delta H_r = -134\ kJ$

$H_r = \frac{\Delta H_r}{n} = \frac{-134\ kJ}{2\ mol}$ **$= -67\ kJ/mol$**

60 - Multi-Step Calculations

* 1. $2C_2H_{6(g)} + 7O_{2(g)} \rightarrow 4CO_{2(g)} + 6H_2O_{(g)} + 2502\ kJ$

$\Delta H = -1500\ kJ$

S1

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-2502\ kJ}{4\ mol} = -625.5\ kJ/mol$

S2

$\Delta H_r = nH_r$

$n = \frac{\Delta H_r}{H_r} = \frac{-1500\ kJ}{-625.5\ kJ/mol} = 2.398\ mol$

S3

$2.398\ mol\ CO_2 \times \frac{44.01\ g\ CO_2}{1\ mol\ CO_2} = \boxed{105.5\ g\ CO_2}$

\- 2 $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$

$\Delta H_r = -192.8\ kJ$

$m = 1.00\ t\ SO_3$

S1

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-192.8\ kJ}{2\ mol} = -96.4\ kJ/mol$

S2

$1000\,000\ g\ SO_3 \times \frac{1\ mol\ SO_3}{80.06\ g\ SO_3} = 12\,490.63\ mol$

S3

12 490.63

$\Delta H_r = nH_r$

$\Delta H_r = (12490.63\ mol)(-96.4\ kJ/mol)$

$\Delta H_r = -1\,204\,097\ kJ$

$\boxed{\Delta H_r = -1.20 \times 10^3\ MJ}$

3. $C_6H_{12}O_{6(s)} + 6O_{2(g)} \rightarrow 6CO_{2(g)} + 6H_2O_{(l)}$ $m = 18.0g$

$\Delta H_r = \Sigma n H_{fp} - \Sigma n H_{fr}$

$\Delta H_r = [(6 mol)(-393.5 \frac{kJ}{mol}) + (6 mol)(-285.8 \frac{kJ}{mol})] - [(1 mol)(-1273.1 \frac{kJ}{mol}) + (6 mol)(0 \frac{kJ}{mol})]$

$\Delta H_r = -2802.7 kJ$

S1

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-2802.7 kJ}{1 mol} = -2802.7 kJ/mol$

S2

$18.0g\ C_6H_{12}O_6 \times \frac{1 mol\ C_6H_{12}O_6}{180.18g\ C_6H_{12}O_6} = 0.100 mol\ C_6H_{12}O_6$

S3

$\Delta H_r = nH_r$

$\Delta H_r = (0.100 mol)(-2802.7 kJ/mol)$

$\boxed{\Delta H_r = -280. kJ}$

4. $CH_3OH_{(l)} + \frac{3}{2}O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$ $m = 3.40g$

$\Delta H_r = \Sigma n H_{fp} - \Sigma n H_{fr}$

$\Delta H_r = [(1 mol)(-393.5 \frac{kJ}{mol}) + (2 mol)(-285.8 \frac{kJ}{mol})] - [(1 mol)(-239.1 \frac{kJ}{mol}) + (\frac{3}{2} mol)(0)]$

$\Delta H_r = -726 kJ$

S1

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{726 kJ}{1 mol} = -726 kJ/mol$

S2

$3.40g\ CH_3OH \times \frac{1 mol\ CH_3OH}{32.05g\ CH_3OH} = 0.106 mol\ CH_3OH$

S3

$\Delta H_r = -q$

$nH_r = -C\Delta T$

$\Delta T = \frac{-(0.106 mol)(-726 kJ/mol)}{(6.75 kJ/°C)}$

$\boxed{\Delta T = 11.4°C}$

5 $H_2S_{(g)} + \frac{3}{2}O_{2(g)} \longrightarrow H_2O_{(g)} + SO_{2(g)}$ $m = 15\,kg$

$\Delta H_r = \sum nH_{fp} - \sum nH_{fr}$

$\Delta H_r = \left[(1\,mol)(-241.8\,\frac{kJ}{mol}) + (1\,mol)(-296.8\,\frac{kJ}{mol})\right] - \left[(1\,mol)(-20.6\,\frac{kJ}{mol}) + (\frac{3}{2}\,mol)(0)\right]$

$\Delta H_r = -518\,kJ$

S_1

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-518\,kJ}{1\,mol} = -518\,kJ/mol$

S_2

$15\,000\,g\ H_2S \times \frac{1\,mol\ H_2S}{34.08\,g\ H_2S} = 440.141\,mol\ H_2S$

S_3

$\Delta H_r = -q$

$nH_r = -vC\Delta T$

$(440.141\,mol)(-518\,kJ/mol) = -(v)(4.19\,\frac{kJ}{L\cdot°C})(64\,°C)$

$v = \frac{(440.141\,mol)(-518\,kJ/mol)}{(4.19\,\frac{kJ}{L\cdot°C})(64\,°C)}$

$v = 850\,L$

77 – Bronsted-Lowry Definitions and Indicators

*1. Bronsted-Lowry acid → proton donor
Bronsted-Lowry base → proton acceptor

*2. a) Acidic solution must have a pH less than 7.
b) No. A Bronsted-Lowry acid is always present with a Bronsted-Lowry base, meaning the solution could be acidic or basic.

*3 a) Amphiprotic → a substance than can accept or donate protons.
b) A substance containing protons and having extra electrons to bond to an H^{+} (often an anion).

*4. $HOOCCOO^{-}_{(aq)} + PO_4^{3-}{}_{(aq)} \rightleftharpoons HPO_4^{2-}{}_{(aq)} + OOCCOO^{2-}_{(aq)}$

(a) A B A B

(b) Pair 1: $HOOCCOO^{-}_{(aq)}$, $OOCCOO^{2-}_{(aq)}$
Pair 2: $PO_4^{3-}{}_{(aq)}$, $HPO_4^{2-}{}_{(aq)}$

(c) Whether $HOOCCOO^{-}_{(aq)}$ or $HPO_4^{2-}{}_{(aq)}$ is a stronger acid (proton donor).

*5. A strong acid has a weak conjugate base.
A weak acid has a strong conjugate base.

*6 - *8 OMIT

Acid-Base Equilibrium

*1 Strongest acid on reactants-side, product-favoured
Strongest acid on products side, reactant-favoured.

*2

SA		SB	
$HNO_{2(aq)}$,	$Na^{+}_{(aq)}$,	$HCO_{3}^{-}{}_{(aq)}$,	$H_2O_{(l)}$
A		A/B	A/B

$$HNO_{2(aq)} + HCO_{3}^{-}{}_{(aq)} \overset{>50\%}{\rightleftharpoons} NO_{2}^{-}{}_{(aq)} + H_2CO_{3(aq)}$$

*3

SA		SB	
$HCOOH_{(aq)}$,	$Na^{+}_{(aq)}$,	$OH^{-}_{(aq)}$,	$H_2O_{(l)}$
A		B	A/B

$$HCOOH_{(aq)} + OH^{-}_{(aq)} \rightarrow HCOO^{-}_{(aq)} + H_2O_{(l)}$$

*4

SA		SB	
$HClO_{(aq)}$,	$Na^{+}_{(aq)}$,	$HCO_{3}^{-}{}_{(aq)}$,	$H_2O_{(l)}$
A		A/B	A/B

$$HClO_{(aq)} + HCO_{3}^{-}{}_{(aq)} \overset{<50\%}{\rightleftharpoons} ClO^{-}_{(aq)} + H_2CO_{3(aq)}$$

*5

	SB	SA		
$Na^{+}_{(aq)}$,	$CN^{-}_{(aq)}$,	$H_3O^{+}_{(aq)}$,	$Cl^{-}_{(aq)}$,	$H_2O_{(l)}$
	B	A	B	A/B

$$H_3O^{+}_{(aq)} + CN^{-}_{(aq)} \rightarrow H_2O_{(l)} + HCN_{(aq)}$$