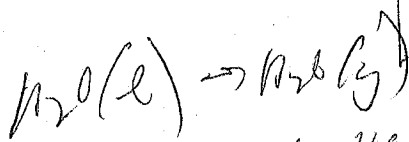


Chap. 5
CN
Feb 15

Slinc #2

$T = 100^\circ\text{C}$
 $= 373\text{K}$

(3)



$$\Delta_{\text{vap}}H^\circ = 40.7 \text{ kJ/mol}$$

$$\Delta W = 40.7 \text{ kJ}$$

$$\Delta PV = PV_g - PV_l \approx 0$$

$$\approx nRT = (1 \text{ mol}) \left(8.31 \frac{\text{J}}{\text{mol}\cdot\text{K}} \right) (373\text{K})$$

$$= 3100 \text{ J} \times \frac{1 \text{ kJ}}{1000 \text{ J}} = 3.1 \text{ kJ}$$

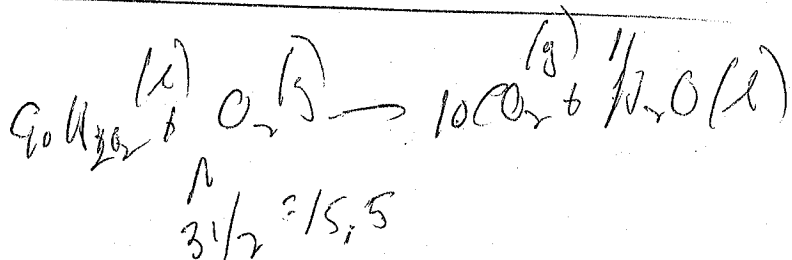
$$\Delta U = \Delta W - \Delta(PV) = 40.7 \text{ kJ} - (3.1 \text{ kJ}) = 37.6 \text{ kJ}$$

$$\Delta W_{\text{total}} = -\Delta W_{\text{exp}} = -40.7 \text{ kJ}$$

CV
Ch. 4
4th Ed

Deane, Barbara

T = 25°C = 298 K (4)



(A) $\Delta H = q = -95 \text{ kJ}$

$$n = \frac{2g}{142g/mol} = 0.0141 \text{ mol}$$

$$\Delta_{\text{comb}} U^\circ = \frac{q}{n} = \frac{-95 \text{ kJ}}{0.0141 \text{ mol}}$$

$$= -6745 \text{ kJ/mol}$$

(B) $\Delta_{\text{comb}} H = \Delta_{\text{comb}} U + \Delta(PV)$
 $= -6745 \text{ kJ/mol} + (-13.6) = -6759 \text{ kJ/mol}$

$$\Delta PV = PV_{\text{prod}} - PV_{\text{react}} = \left[\cancel{PV_{\text{C}_2\text{H}_2}} + PV_{\text{CO}_2} + PV_{\text{H}_2\text{O}} \right] - \left[PV_{\text{C}_2\text{H}_2} + PV_{\text{O}_2} \right]$$

$$= n_{\text{CO}_2} RT - n_{\text{O}_2} RT = RT [10 - 15.5]$$
$$= 8.31 / (8.31) (298 \text{ K}) = -13,600 \text{ J} \times \frac{1 \text{ kJ}}{1000 \text{ J}}$$
$$= -13.6 \text{ kJ}$$

Chap. 3
Feb 7

Example: Condensation of Water Vapor

$$n = \frac{100 \text{ g}}{18 \text{ g/mol}} = 5.56 \text{ mol}$$

Example: Calculate q , w , ΔU , and ΔH when 100 g of H_2O gas is condensed to the liquid at 1 bar and 100°C .

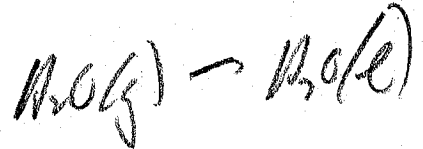
$$\Delta U = n \Delta_{\text{cond}} H = 5.56 \text{ mol} (-40.7 \text{ kJ/mol})$$
$$q = -226 \text{ kJ}$$

$$\Delta_{\text{vap}} H^\circ = 40.7 \text{ kJ/mol}$$

$$M = 18$$

$$\Delta_{\text{cond}} H^\circ = -40.7 \text{ kJ/mol}$$

$$w = -P \Delta V = -P(V_{\text{liq}} - V_{\text{gas}})$$



$$= +PV_{\text{gas}} = nRT$$

$$= 5.56 \text{ mol} (0.08315 \text{ kJ/mol}\cdot\text{K})(383 \text{ K})$$

$$= +17,200 \text{ J} = 17.2 \text{ kJ} = \boxed{17 \text{ kJ}}$$

$$\Delta U = q + w = -226 + (17)$$

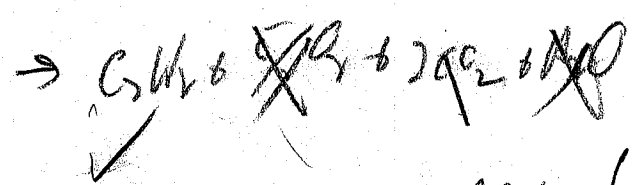
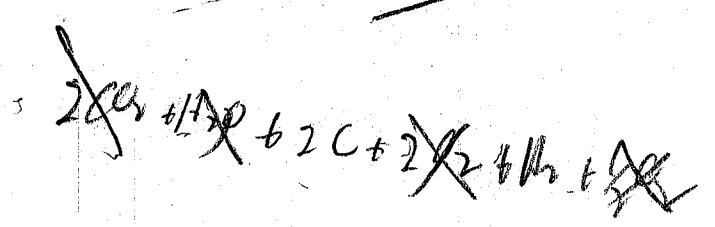
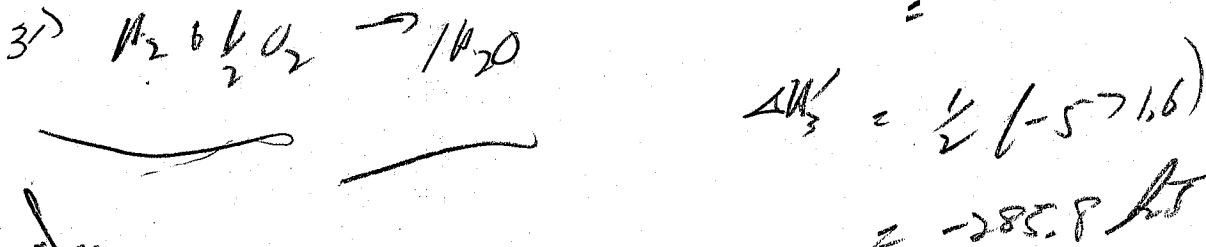
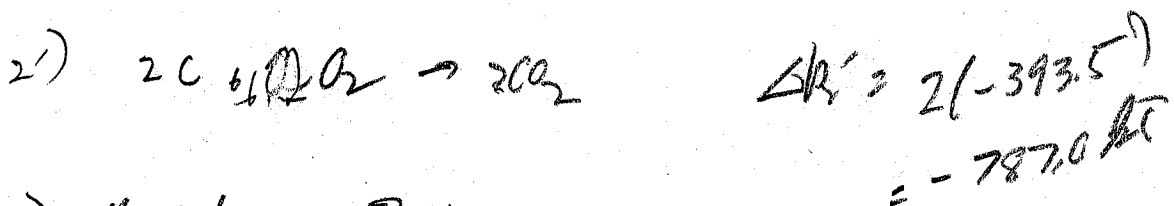
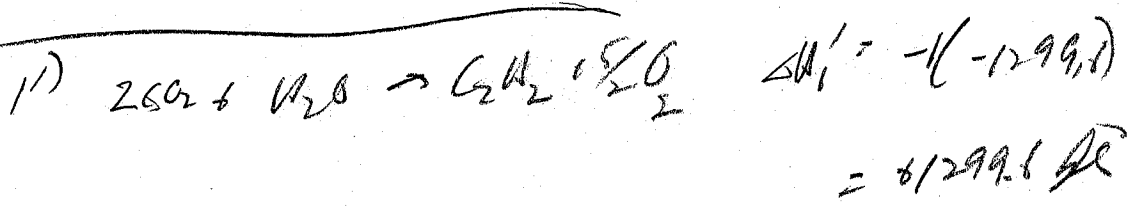
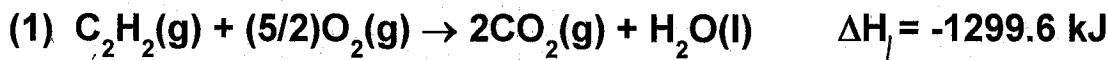
$$= -209 \text{ kJ}$$

Chap. 3
Feb. 7

Hess's Law Review Example #1 (Slide #30)



Determine the enthalpy change for the formation of acetylene,
 $2C(s) + H_2(g) \rightarrow C_2H_2(g)$ $\Delta H^\circ = ???$
from the thermochemical equations below.



$$\Delta H = +1299.6 + (-787.0) + (-285.8)$$
$$= +226.8 \text{ kJ}$$

Chap. 3
Feb 7

Example: Condensation of Water Vapor

$$n = \frac{100 \text{ g}}{18 \text{ g/mol}} = 5.56 \text{ mol}$$

Example: Calculate q , w , ΔU , and ΔH when 100 g of H_2O gas is condensed to the liquid at 1 bar and 100°C .

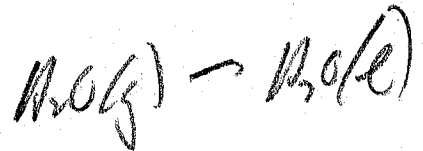
$$\Delta H = n \Delta_{\text{cond}} H = 5.56 \text{ mol} (-40.7 \text{ kJ/mol})$$
$$q = -226 \text{ kJ}$$

$$\Delta_{\text{vap}} H^\circ = 40.7 \text{ kJ/mol}$$

$$M = 18$$

$$\Delta_{\text{cond}} H^\circ = -40.7 \text{ kJ/mol}$$

$$w = -P \Delta V = -P(V_{\text{liq}} - V_{\text{gas}})$$



$$= +PV_{\text{gas}} = nRT$$

$$= 5.56 \text{ mol} (8.315 \text{ J/mol}\cdot\text{K})(383 \text{ K})$$

$$= +17,200 \text{ J} = 17.2 \text{ kJ} = \boxed{17 \text{ kJ}}$$

$$\Delta U = q + w = -226 + (17)$$

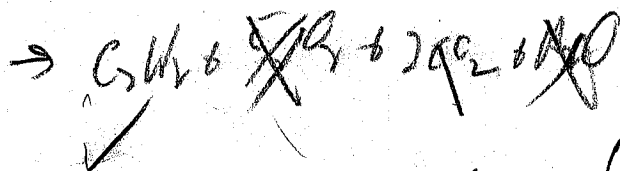
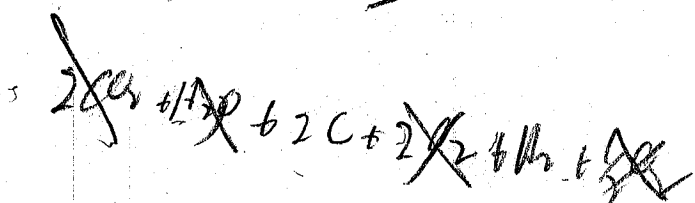
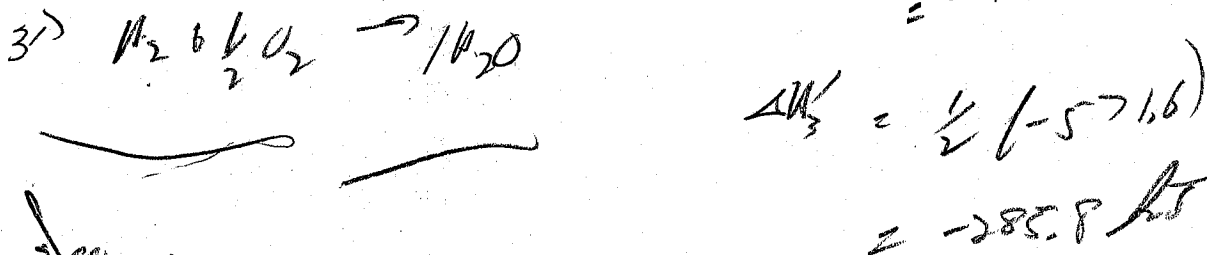
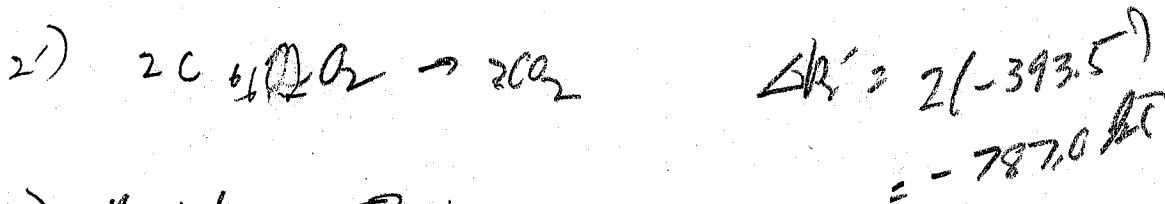
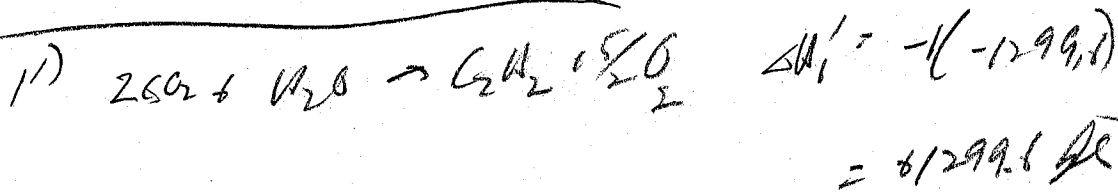
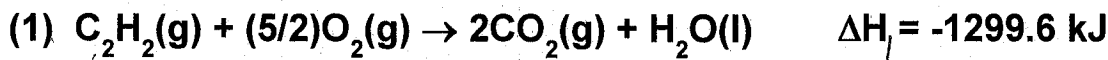
$$= -209 \text{ kJ}$$

Chap. 3
Feb. 7

Hess's Law Review Example #1 (Slide #30)



Determine the enthalpy change for the formation of acetylene,
 $2C(s) + H_2(g) \rightarrow C_2H_2(g)$ $\Delta H^\circ = ???$
from the thermochemical equations below.



$$\Delta H = +1299.6 + (-787.0) + (-285.8)$$
$$= +226.8 \text{ kJ}$$

Chap. 3
Feb 7

Example: Condensation of Water Vapor

$$n = \frac{100 \text{ g}}{18 \text{ g/mol}} = 5.56 \text{ mol}$$

Example: Calculate q , w , ΔU , and ΔH when 100 g of H_2O gas is condensed to the liquid at 1 bar and 100°C .

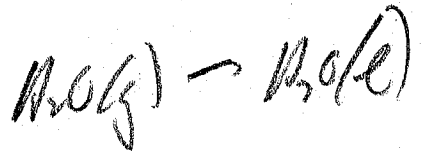
$$\Delta U = n \Delta_{\text{cond}} H = 5.56 \text{ mol} (-40.7 \text{ kJ/mol})$$
$$q = -226 \text{ kJ}$$

$$\Delta_{\text{vap}} H^\circ = 40.7 \text{ kJ/mol}$$

$$M = 18$$

$$\Delta_{\text{cond}} H^\circ = -40.7 \text{ kJ/mol}$$

$$w = -P \Delta V = -P(V_{\text{liq}} - V_{\text{gas}})$$



$$= +PV_{\text{gas}} = nRT$$

$$= 5.56 \text{ mol} (8.314 \text{ J/mol}\cdot\text{K})(383 \text{ K})$$

$$= +17,200 \text{ J} = 17.2 \text{ kJ} = \boxed{17 \text{ kJ}}$$

$$\Delta U = q + w = -226 + (17)$$

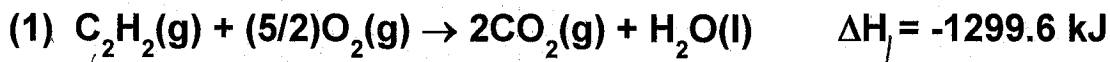
$$= -209 \text{ kJ}$$

Chap. 3
Feb. 7

Hess's Law Review Example #1 (Slide #30)



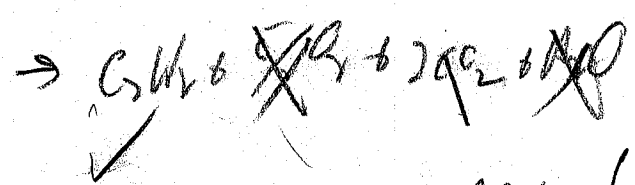
Determine the enthalpy change for the formation of acetylene,
 $2C(s) + H_2(g) \rightarrow C_2H_2(g)$ $\Delta H^\circ = ???$
from the thermochemical equations below.



1') $2CO_2 + H_2O \rightarrow C_2H_2 + \frac{5}{2}O_2$ $\Delta H_1' = -1(-1299.6)$
 $= +1299.6 \text{ kJ}$

2') $2C + 2O_2 \rightarrow 2CO_2$ $\Delta H_2' = 2(-393.5)$
 $= -787.0 \text{ kJ}$

3') $H_2 + \frac{1}{2}O_2 \rightarrow H_2O$ $\Delta H_3' = \frac{1}{2}(-571.6)$
 $= -285.8 \text{ kJ}$

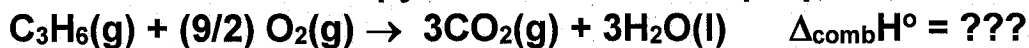


$$\Delta H = +1299.6 + (-787.0) + (-285.8)$$
$$= +226.8 \text{ kJ}$$

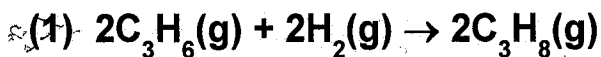
Chap. 3
Feb. 12

Hess's Law Review Example #2 (Slide #31)

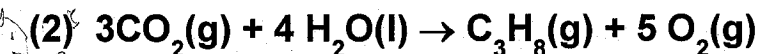
Determine the enthalpy of combustion of propene,



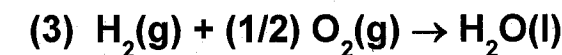
from the thermochemical equations below



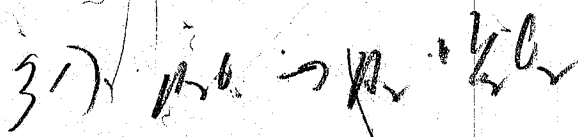
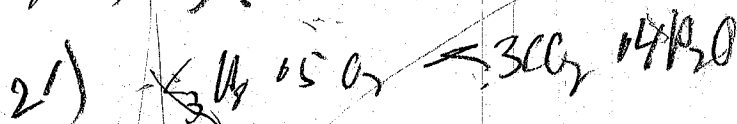
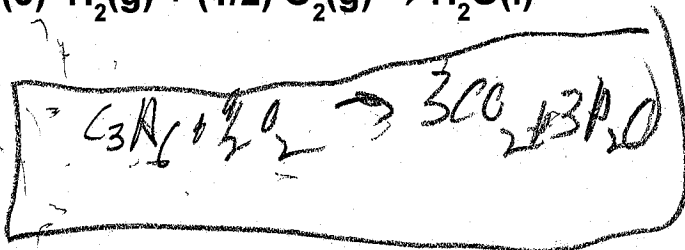
$$\Delta\text{H} = -248 \text{ kJ}$$



$$\Delta\text{H} = +2220 \text{ kJ}$$



$$\Delta\text{H} = -286 \text{ kJ}$$



$$\Delta\text{H}'_1 = \frac{1}{2}(-248)$$

$$\Delta\text{H}'_2 = -(+2220) = -2220$$

$$\Delta\text{H}'_3 = +286$$

$$\Delta\text{H} = \frac{1}{2}(-248) - (2220) + 286$$

$$= -2058 \text{ kJ}$$

Ch 3
Feb 12

Ex 8 (36)

(L)

$$\begin{aligned}\Delta H &= [2 \Delta_f H^\circ(\text{CO}_2, \text{g}) + 2 \Delta_f H^\circ(\text{CO}_2)] \\ &\quad - [1 \Delta_f H^\circ(\text{C}_6\text{H}_{12}\text{O}_6)] \\ &= 2(-393.5) + 2(-393.5) - (-1268) \\ &= -730 \text{ kJ}\end{aligned}$$

Ex 8 (37)

$$\begin{aligned}\Delta H &= 6 \Delta_f H^\circ(\text{CO}_2) + 6 \Delta_f H^\circ(\text{H}_2\text{O}) \\ &\quad - [1 \Delta_f H^\circ(\text{C}_6\text{H}_{12}\text{O}_6) + 6(0)] \\ &= -2808 \text{ kJ}\end{aligned}$$

CR3
F12

$$\underline{FV - 51 \text{ 38}}$$

(3)

$$\Delta H = -3236 = [6(-3925) + 7(-285,8) + 1(0)] - [2X + 0]$$

$$-3236 = -2X - 4361,6$$

$$2X = -4361,6 - (-3236)$$

$$2X = -1125,6$$

$$X = \frac{-1125,6}{2}$$

$$= -562,8 \text{ kJ/l}$$

$X = \text{C}_2\text{H}_2\text{O}_2\text{N}$