

Name: _____

date: _____ period: _____

ch. 10 heat & heating curve

test

45 points (4 ec)

ngss chemistry

In problems involving any calculation, show your work in an organized manner, include any relevant conversion factor(s) and equation (or formula) and units in your answer.

1. Solve for ΔH_{Rxn} : $CH_4 + O_2 \rightarrow CO_2 + H_2O$ using bond enthalpy. [15 points]

hint: sketch Lewis structures & balance chemical equation

5 pt $H-\overset{H}{\underset{H}{C}}-H + 2 O_2 \rightarrow O=C=O + 2 H-O-H$

2 pt $\Delta H = \sum D(\text{break}) - \sum D(\text{form})$

3 $= [4D(C-H) + 2D(O=O)] - [2D(C=O) + 4D(O-H)]$

3 $= [4(413) + 2(495)] - [2(799) + 4(463)]$

2 $= [1652 + 990] - [1598 + 1852]$

$= 2642 - 3450$

$= -808 \text{ kJ}$

2. What is the "final" temperature of mixing 25 mL of water at 20 °C and 75 mL of water at 85 °C? [10 points] hint: thermochem lab

$\sum q = 0$

2 $m_{hot} C \Delta T_{hot} = -m_{cold} C \Delta T_{cold}$

2 $m_{hot} (T_f - T_{i, hot}) = -m_{cold} (T_f - T_{i, cold})$

2 $75 (T_f - 85) = -25 (T_f - 20)$

2 $75 T_f + 2 T_f = 75(85) + 25(20)$

$100 T_f = 76375 + 500$

$T_f = 68.75 \text{ } ^\circ\text{C}$

3. For ethanol, C₂H₅OH,

Specific heat

Solid = 111 J / (mol °C)

melting point = - 114 °C

ΔH (fusion) = 4.97 kJ / mol

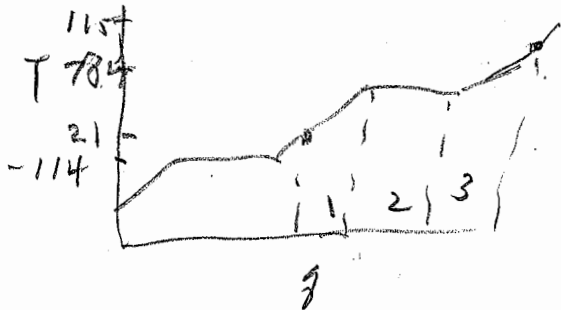
Liquid = 2.43 J / (g °C)

boiling point = 78.4 °C

ΔH (vaporization) = 42.3 kJ / mol

Gas = 1.70 J / (g K)

How much heat would be needed to change 10.0 ethanol at 21.0 °C to 115 °C ? [20 points]



4 pt @

$$q_1 = m c_s \Delta T = 10 \text{ g} \left(\frac{2.43 \text{ J}}{\text{g}^\circ\text{C}} \right) (78.4 - 21) = 1395 \text{ J}$$

$$q_2 = \Delta H_{\text{vap}} \cdot m = \frac{42.3 \text{ kJ}}{\text{mol}} \cdot 10 \text{ g} \cdot \frac{1 \text{ mol}}{46 \text{ g}} = 9.196 \text{ kJ}$$

$$q_3 = m c_g \Delta T = 10 \text{ g} \left(\frac{1.7 \text{ J}}{\text{g}^\circ\text{C}} \right) (115 - 78.4)^\circ\text{C} = 622 \text{ J}$$

$$q = \sum_{i=1}^3 q_i = (1.395 + 9.196 + 0.622) \text{ kJ} = 11.2 \text{ kJ}$$

4. Fill-in the table below. [4 points]

1 pt @

Type reaction	ΔH: positive or negative ?	Consume or generate heat ?
Endothermic	+	consume
Exothermic	-	generate