Name: _____ date: _____ period: _____

ch. 13 enthalpy of reaction; dH_f; stochiometry test 45 50 points 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. In regards to the reaction: $2\ C_2H_{6(g)} + 7\ O_{2(g)} \rightarrow 4\ CO_{2(g)} + 6\ H_2O_{(g)}$ [20 points]

a. what is ΔH_{Rx} ?

2 pt
2
1

$\Delta H = [4\Delta H_f CO_2 + 6\Delta H_f H_2O] - [2\Delta H_f C_2H_6 + 7\Delta H_f O_2]$

$= [4(-393.5) + 6(-242)] - [2(-85) + 2(0)]$

$= -1574 - 1452 + 170$

$= -2856\ kJ$

b. what is ΔH_{Rx} : 5.0 grams $C_2H_{6(g)}$ + excess $O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}$

4 pt
1

$-\frac{2856\ kJ}{2\ mol\ C_2H_6}\left(5.0\ g\ C_2H_6 \frac{1\ mol\ C_2H_6}{30.0\ g\ C_2H_6}\right)$

$= -238\ kJ$

c. what is ΔH_{Rx} : 10.0 grams $C_2H_{6(g)}$ + 20.0 grams $O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}$

3 pt
2

i) $10.0\ g\ C_2H_6 \frac{1\ mol\ C_2H_6}{30.0\ g\ C_2H_6} \frac{7\ mol\ O_2}{2\ mol\ C_2H_6} \frac{32.0\ g\ O_2}{1\ mol\ O_2} = 37.3\ g\ O_2$ needed

hmm $20.0\ g\ O_2 \rightarrow$ O_2 is limiting

3
2

ii) $\left(20.0\ g\ O_2 \frac{1\ mol\ O_2}{32.0\ g\ O_2}\right)\left(\frac{-2856\ kJ}{7\ mol\ O_2}\right) =$

$= -255\ kJ$

2. In regards to the reaction: NaOH(s) → NaOH(aq) [15 points]

a. what is ΔH_{Rx} ?

2 pts: 2, 1

$\Delta H = \Delta H_f\ NaOH_{(aq)} - \Delta H_f\ NaOH_{(s)}$

$= -469.6 - -425.6$

$= -44\ kJ$

b. how many grams of solid NaOH should be added to 175 mL of water at 21 °C to change its temperature by 8.0 °C ?

2 + 2: i) 1 + 1

$q = -mc\Delta T = 175\ g \left(\frac{4.18\ J}{g \cdot °C}\right)(8 \cdot °C)$

$= -5852\ J$

ii) 2, 2, 1

$\Delta H \cdot n = q$

$-44\ kJ \cdot n \frac{1\ mol}{40\ g} = -5852\ J \frac{kJ}{10^3\ J}$

$n = 5.32\ g$

3. If the addition of 15.0 grams of ice at O °C to 125 mL of water at 21 °C, the final temperature is 11.43 °C. Based on this information, what is ΔH_{fusion} ? For simplicity, ignore heating the melted ice as a liquid at O °C to the "final" temperature. [15 points]

2 + 2 pts: i) 1 pt

$\Delta H = -mc\Delta T = -125\ g \left(\frac{4.18\ J}{g \cdot °C}\right)(11.43 - 21) \cdot °C$

$= 5000\ J$ for $15\ g$ ice

ii) 3 pts: 2

$\Delta H = \frac{5000\ J}{15\ g\ H_2O} \frac{kJ}{10^3\ J} \frac{18\ g}{mol}$

$= 6\ kJ$