$\Delta H = n \Delta_r H$

Chapter 9 Worksheet #3: Enthalpy Changes

1. Iron (II) sulfide ore is roasted according to the following chemical equation

$$4\,FeS_{(s)} + 7\,O_{2(g)} \rightarrow 2\,Fe_2O_{3(s)} + 4\,SO_{2(g)} \qquad \Delta H = -2456\ kJ$$

a) What is the molar enthalpy of reaction for iron (II) sulfide?

$\Delta_r H_{FeS} = \frac{\Delta H}{n} = \frac{-2456\ kJ}{4\ mol\ FeS} = -614\ \frac{kJ}{mol}$

b) What is the molar enthalpy of reaction for iron (III) oxide?

$\Delta_r H_{Fe_2O_3} = \frac{\Delta H}{n} = \frac{-2456\ kJ}{2\ mol\ Fe_2O_3} = -1228\ \frac{kJ}{mol}$

c) What is the enthalpy change when 100 grams of iron (II) sulfide reacts?

$\Delta H = n \Delta_r H_{FeS} = \frac{100g}{87.92\frac{g}{mol}} \times -614\ \frac{kJ}{mol} = -698\ kJ$

d) What is the quantity of energy released from the production of 0.100 mol of sulfur dioxide? (enthalpy change)

$\Delta H = n \Delta_r H = 0.100\ mol \times -614\ \frac{kJ}{mol} = -61.4\ kJ$

① $\Delta_r H_{SO_2} = \frac{\Delta H}{n} = \frac{-2456\ kJ}{4\ mol\ SO_2} = -614\ \frac{kJ}{mol}$

2. Boron reacts with hydrogen to form diboron hexahydride gas according to the following equation

$$2\,B\,(s) + 3\,H_2(g) \longrightarrow B_2H_6\,(s) \qquad \Delta H = +31.4\ kJ$$

The molar enthalpy of reaction for boron is +15.7 kJ/mol

a) Calculate the enthalpy change for the balanced reaction.

$\Delta H = +15.7\ \frac{kJ}{mol} \times 2\ mol\ B = +31.4\ kJ$

b) What is the enthalpy change for the production of 10.0 grams of diboron hexahydride?

$\Delta H = n \Delta_r H$

$= \frac{10.0g}{27.68\frac{g}{mol}} \times +31.4\ \frac{kJ}{mol} = +11.3\ kJ$

① $\Delta_r H_{B_2H_6} = \frac{\Delta H}{n} = \frac{+31.4\ kJ}{1\ mol} = +31.4\ \frac{kJ}{mol}$

c) How much hydrogen will be used up when 100 kJ of energy is absorbed?

$\Delta_r H_{H_2} = \frac{\Delta H}{n} = \frac{+31.4\ kJ}{3\ mol\ H_2} = +10.47\ \frac{kJ}{mol}$

$n = \frac{\Delta H}{\Delta_r H} = \frac{+100\ kJ}{+10.47\ \frac{kJ}{mol}}$

$= 9.55\ mol \times 2.02\ \frac{g}{mol}$

$m = nM$