Question 7

Iron reacts with steam according to the equation:

$$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$$

In an experiment, 24.5 g of iron were reacted with 12.6 g of steam. Calculate:

a) the mass of Fe_3O_4 produced.

Mole of product formed based on LR

There are **3 methods** to determine the LR:

1) Compare mole ratios of the reactants

2) Compare the amount of products based on different reactants

3) Compare the mole needed vs mole required

Lets say we use mole ratio of the reactant to determine the LR

First, calculate mole of reactants available

$$\text{Mole Fe available} = \frac{\text{mass Fe}}{\text{Molar mass Fe}}$$

$$= \frac{\quad}{\quad}$$

$$= \quad \text{mol Fe available}$$

Ar of Fe = 55.9

Ar of H = 1

Ar of O = 16

$$\text{Mole Steam available} = \frac{\text{mass } H_2O}{\text{Molar mass H2O}}$$

$$= \frac{\quad}{\quad}$$

= mol H_2O @ steam available

Compare the mole ratio of the reactants

$$3Fe(s) + 4H_2O(g) \longrightarrow Fe_3O_4(s) + 4H_2(g)$$

Mole ratio of Fe = $\frac{\text{mol of Fe}}{\text{S. Coefficient Fe}}$ = _____ =

Mole ratio of H_2O = $\frac{\text{mol of } H_2O}{\text{S. Coefficient } H_2O}$ = _____ =

Mole ratio of Fe _____mole ratio of H_2O

Limiting reactant is _____

From the balanced equation

___ mol Fe = ___ mol Fe_3O_4

_____ mol Fe = ___ x _____mol Fe_3O_4

= _____ mole Fe3O4

Mole Fe_3O_4 = $\frac{\text{mass } Fe_3O_4}{\text{Molar mass } Fe_3O_4}$

Ar of Fe = 55.8

Ar of O = 16

Mass of Fe_3O_4 = Mole x Molar mass Fe_3O_4

= _____ g

Mole of H_2 produced depends on LR

b) calculate the volume of H_2 formed at STP.

What is molar volume at 0^0C and 1atm@ STP?

From the balanced equation

____ mol Fe = ____ mol H_2

_____ mol Fe = ___ x _____ mol H_2

= _____ mol H_2

At STP, 1 mol $H_{2\ gaseous}$ will occupies _____ L

Vol of H_2 at STP = mole H_2 x Molar volume at STP

= _____mole x _____L/mole

= _____ L