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

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

= _____

= _____ mol Fe available

> Ar of Fe = 55.9
>
> Ar of H = 1
>
> Ar of O = 16

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

= _____

= _____ mol H_2O @ steam available

Compare the mole ratio of the reactants

$$3Fe(s) + 4H_2O(g) \longrightarrow Fe_3O_4(s) + 4H_2(g)$$
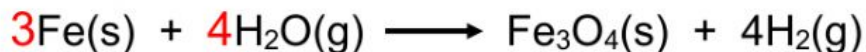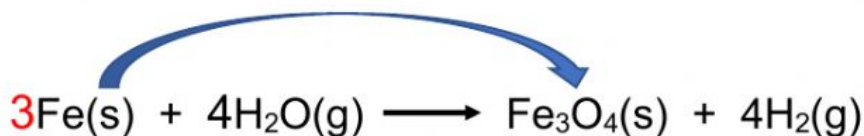
Mole ratio of Fe = $\dfrac{\text{mol of Fe}}{\text{S. Coefficient Fe}}$ = _____ =

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

Mole ratio of Fe _____ mole ratio of H_2O

Limiting reactant is _____

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

From the balanced equation

___ mol Fe = ___ mol Fe_3O_4

_____ mol Fe = ___ x _____ mol Fe_3O_4

= _____ mole Fe3O4

Mole Fe_3O_4 = $\dfrac{\text{mass } Fe_3O_4}{\text{Molar mass } Fe_3O_4}$
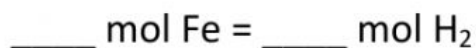
Ar of Fe = 55.8

Ar of O = 16

Mass of Fe_3O_4 = Mole x Molar mass Fe_3O_4

= _____ g

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Mole of H_2 produced depends on LR

b) calculate the volume of H_2 formed at STP.

From the balanced equation

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

_____ mol Fe = _____ mol H_2

_____ mol Fe = ___ x _____ mol H_2

= _____ mol H_2

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

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

= _____mole x _____L/mole

= _____ L

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