Question #77397 - Chemistry - General Chemistry

$Fe+O_2=Fe_2O_3$

If steel wool (iron) is heated until it glows and is placed in a bottle containing pure oxygen, the iron reacts spectacularly to produce iron(III) oxide.

If 1.28 g of iron is heated and placed in a bottle containing 0.0187 mol of oxygen gas, what mass of iron(III) oxide is produced?

Solution

$4Fe+3O_2=2Fe_2O_3$

Mole Ratio 4:3:2

mass of Fe = 1.28 g

n(Fe) = m(Fe) / molar mass(Fe)

M(Fe) = 55.85 g/mol

n(Fe) = 1.28/55.85 = 0.0229 mol

$n(O_2)$ = 0.0187 mol

First we need to find the limiting reagent.

n(Fe) needed = 0.0187 mol O_2 * 4 mol Fe/3 mol O_2 = 0.0249 mol

Therefore, Fe is limiting reagent.

Thus, we use the moles of Fe to continue with calculations.

$n(Fe_2O_3)$ = 0.0229 mol (Fe) * 2 mol (Fe_2O_3)/4 mol (Fe) = 0.01145 mol

$M(Fe_2O_3)$ = 159.70 g/mol

$m(Fe_2O_3) = n(Fe_2O_3) * M(Fe_2O_3)$ = 0.01145 * 159.70 = 1.829 g

Answer

1.829 g iron(III) oxide is produced.

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