Gravimetric Stoichiometry

Gravimetric - refers to mass measurement
Stoichiometric - refers to the procedure used to calculate quantities of chemicals.
GRAVIMETRIC STOICHIOMETRY - the procedure for calculating the masses of reactants and products in a chemical reaction.

 ASSUMPTIONS IN STOICHIOMETRY
- the reaction is spontaneous.
- the reaction is fast
- the reaction is quantitative.
- the reaction is stoichiometric.
     (there is a whole number ratio between MOLES of reactant and MOLES of product.)

What mass of iron (III) oxide is required to produce 1000. g of iron according to the following reaction?

UNKNOWN

$Fe_2O_{3(s)} + 3CO_{(g)} \longrightarrow$ KNOWN $2Fe_{(s)} + 3CO_{2(g)}$

m = ?   m = 1000. g
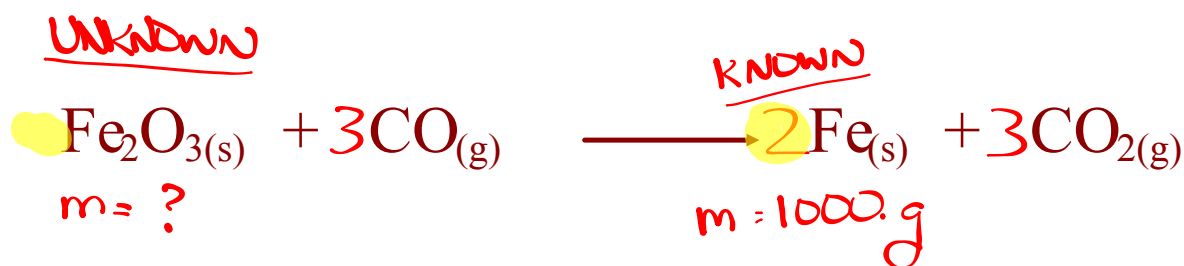
Step 1: # moles known

$1000. \text{ g Fe} \times \dfrac{1 \text{ mol Fe}}{55.85 \text{ g Fe}} = 17.905 \text{ mol Fe}$

Step 2: moles unknown

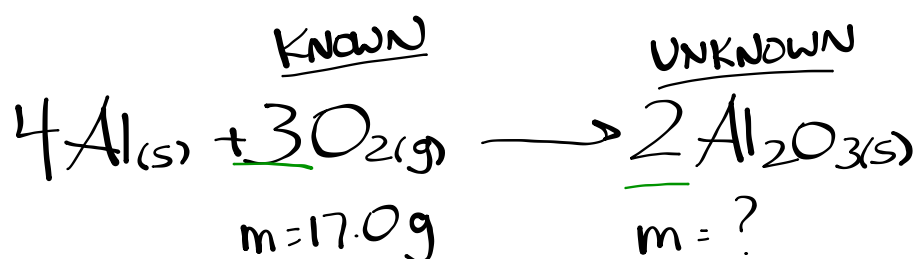$17.905 \text{ mol Fe} \times \dfrac{1 \text{ mol Fe}_2O_3}{2 \text{ mol Fe}} = 8.953 \text{ mol Fe}_2O_3$

Step 3: mass unknown

$8.953 \text{ mol Fe}_2O_3 \times \dfrac{159.70 \text{ g Fe}_2O_3}{1 \text{ mol Fe}_2O_3}$ = $\boxed{1430 \text{ g Fe}_2O_3}$

Try This

Al^{3+} O^{2-}

What mass of aluminum oxide will be produced if 17.0 g of oxygen reacts with excess aluminum?

KNOWN   UNKNOWN

$$4Al_{(s)} + 3O_{2(g)} \longrightarrow 2Al_2O_{3(s)}$$

$$m = 17.0 \, g \qquad\qquad m = ?$$

Step 1: Moles Known

$$17.0 \, g \, O_2 \times \frac{1 \, mol \, O_2}{32.00 \, g \, O_2} = 0.53125 \, mol \, O_2$$

Step 2: Moles Unknown

$$0.53125 \, mol \, O_2 \times \frac{2 \, mol \, Al_2O_3}{3 \, mol \, O_2} = 0.3542 \, mol \, Al_2O_3$$

Step 3: Mass Unknown

$$0.3542 \, mol \, Al_2O_3 \times \frac{101.96 \, g \, Al_2O_3}{1 \, mol \, Al_2O_3} = \boxed{36.1 \, g \, Al_2O_3}$$