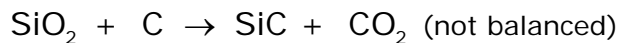


Limiting Reactants: Problems

- 1** Silicon carbide, commonly known as carborundum, is very hard and abrasive. The compound is prepared by heating silicon dioxide in the presence of graphitic carbon:



How many grams of silicon carbide can be formed from 50 g of graphite and 50 g of silicon dioxide?

SOL: 33.4 g

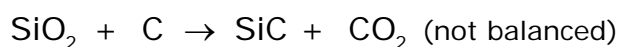
Atomic weights: Si=28.09; O=16; C=12.01

- 2** Elemental phosphorus, P_4 , reacts vigorously with oxygen to give P_4O_{10} . How much P_4O_{10} can be prepared from 3.75 g of P_4 and 6.55 g O_2 ? How much of the excess reactant will remain at the end of the reaction?

SOL: 8.60 g P_4O_{10} ; 1.70 g O_2 left unreacted

Atomic weights: O=16; P=30.97

- 1 Silicon carbide, commonly known as carborundum, is very hard and abrasive. The compound is prepared by heating silicon dioxide in the presence of graphitic carbon:



How many grams of silicon carbide can be formed from 50 g of graphite and 50 g of silicon dioxide?

SOL: 33.4 g

Atomic weights: Si=28.09; O=16; C=12.01

① → The molar masses are

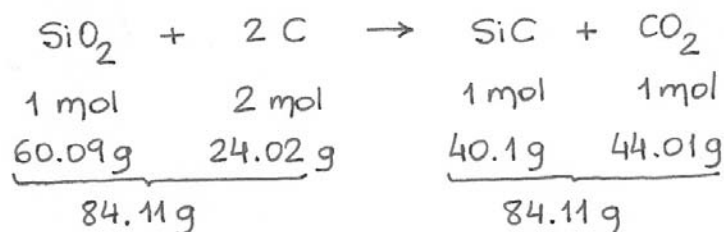
$$M(\text{SiO}_2) = 28.09 + (2 \times 16) = 60.09 \text{ g/mol}$$

$$M(\text{C}) = 12.01 \text{ g/mol}$$

$$M(\text{SiC}) = 28.09 + 12.01 = 40.1 \text{ g/mol}$$

$$M(\text{CO}_2) = 12.01 + (2 \times 16) = 44.01 \text{ g/mol}$$

→ This is the adjusted equation and the proportions of the substances:



→ Determination of the limiting reactant:

$$x(\text{SiO}_2) = \frac{50 \text{ g SiO}_2}{60.09 \text{ g SiO}_2} = 0.83 \text{ times the value of the table are involved in the reaction}$$

→ LIMITING REACTANT

$$x(\text{C}) = \frac{50 \text{ g C}}{24.02 \text{ g C}} = 2.08 \text{ times the value of the table are involved in the reaction}$$

→ REACTANT IN EXCESS

→ calculation of the mass of silicon carbide formed in this reaction:

$$m(\text{SiC}) = 50 \text{ g SiO}_2 \frac{40.1 \text{ g SiC}}{60.09 \text{ g SiO}_2} = \boxed{33.37 \text{ g SiC}}$$

2 Elemental phosphorus, P_4 , reacts vigorously with oxygen to give P_4O_{10} . How much P_4O_{10} can be prepared from 3.75 g of P_4 and 6.55 g O_2 ? How much of the excess reactant will remain at the end of the reaction?

SOL: 8.60 g P_4O_{10} ; 1.70 g O_2 left unreacted

Atomic weights: O=16; P=30.97

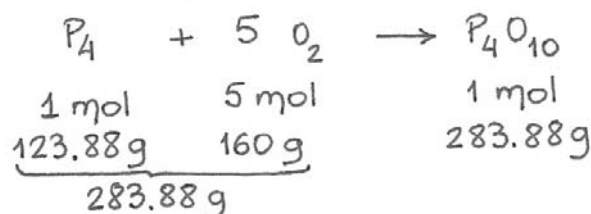
② \rightarrow The molar masses are:

$$M(P_4) = 4 \times 30.97 = 123.88 \text{ g/mol}$$

$$M(O_2) = 2 \times 16 = 32 \text{ g/mol}$$

$$M(P_4O_{10}) = (4 \times 30.97) + (10 \times 16) = 283.88 \text{ g/mol}$$

\rightarrow This is the balanced equation and the proportions in which they react and are formed:



\rightarrow Determination of the limiting reactant

$$x(P_4) = \frac{3.75 \text{ g } P_4}{123.88 \text{ g } P_4} = 0.03 \text{ times the value of the table are involved in the reaction}$$

\rightarrow LIMITING REACTANT

$$x(O_2) = \frac{6.55 \text{ g } O_2}{160 \text{ g } O_2} = 0.04 \text{ times the value of the table are involved in this reaction}$$

\rightarrow REACTANT IN EXCESS

\rightarrow Mass of P_4O_{10} prepared:

$$m(P_4O_{10}) = 3.75 \text{ g } P_4 \frac{283.88 \text{ g } P_4O_{10}}{123.88 \text{ g } P_4} = \boxed{8.59 \text{ g } P_4O_{10}}$$

\rightarrow The excess of reactant

$$m(O_2 \text{ consumed}) = 3.75 \text{ g } P_4 \frac{160 \text{ g } O_2}{123.88 \text{ g } P_4} = 4.84 \text{ g } O_2$$

$$m(O_2, \text{ excess}) = 6.55 \text{ g } O_2 - 4.84 \text{ g } O_2 = \boxed{1.71 \text{ g } O_2 \text{ in excess}}$$