9/28/2018

$2C_2H_6(g) + 7O_2(g) \longrightarrow 4CO_2(g) + 6H_2O(g)$

ex: $7\,mol\ O_2 = 4\,mol\ CO_2$

Example: How many mol of CO_2 are formed if $12.0\,mol\ O_2$ are consumed?

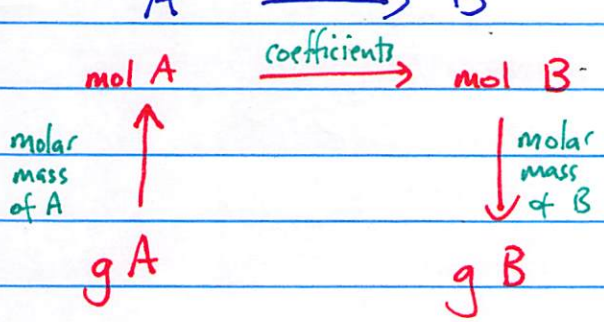
$$12.0\,mol\ O_2 \times \frac{4\,mol\ CO_2}{7\,mol\ O_2} = 6.86\,mol\ CO_2$$

ex: $3.6\,mol\ C_2H_6 \longrightarrow ?\ mol\ H_2O$

$$3.6\,mol\ C_2H_6 \times \frac{6\,mol\ H_2O}{2\,mol\ C_2H_6} = \underline{10.8}\ mol\ H_2O$$

Way more useful to work w/ masses!

ex:



Q: $20.2\,g\ C_2H_6 \longrightarrow ?\,g\ CO_2$

$$2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$$

mol C_2H_6 —(2) coefficients→ mol CO_2

(1) molar mass C_2H_6 ↑ g C_2H_6

mol CO_2 ↓ (3) molar mass CO_2 → g CO_2

(1) C_2H_6

$2 \times C = 2 \times 12.01$

$6 \times H = 6 \times 1.008$

$30.07\,g/mol$

(2) $2\,mol\ C_2H_6 = 4\,mol\ CO_2$

(3) CO_2 $1 \times C = 12.01$

$2 \times O = 2 \times 16.00$

$44.01\,g/mol$

$$20.2\,g\ C_2H_6 \left| \frac{1\,mol\ C_2H_6}{30.07\,g\ C_2H_6} \right| \frac{4\,mol\ CO_2}{2\,mol\ C_2H_6} \left| \frac{44.01\,g\ CO_2}{1\,mol\ CO_2} \right. = 59.1\,g\ CO_2$$

Q: How many ~~g~~ H_2O are formed if $17.5\,g\ O_2$ are used-up?

$$2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$$

$?\,mol\ O_2$ —(2) coefficients→ $?\,mol\ H_2O$

(1) molar mass O_2 ↑ $17.5\,g\ O_2$

$?\,mol\ H_2O$ ↓ (3) molar mass H_2O → g H_2O

(1) O_2

$2 \times O = 2 \times 16.00$

$32.00\,g/mol$

(3) H_2O

$2 \times H = 2 \times 1.008$

$1 \times O = 1 \times 16.00$

$18.02\,g/mol$

(2) $7\,mol\ O_2 = 6\,mol\ H_2O$

(1) (2) (3)

A: $\frac{17.5\,g\,O_2}{} \left| \frac{1\,mol\,O_2}{32.00\,g\,O_2} \right| \frac{6\,mol\,H_2O}{7\,mol\,O_2} \left| \frac{18.02\,g\,H_2O}{1\,mol\,H_2O} \right. = 8.45\,g\,H_2O$

4.3 Limiting Reactants, Theoretical Yield, and Percent Yield.

consider: 2 sl. bread + 1 sl. cheese $\xrightarrow{\Delta}$ 1 grilled cheese (gc)

If we have, say, 10 sl bread + 8 sl. cheese.
- how many grilled cheeses can we make?

STOICHIOMETRY: $10\,\text{sl. bread} \times \frac{1\,gc}{2\,\text{sl. bread}} = \boxed{5\,gc}$ "theoretical yield"

smaller amt formed!

Limiting reactant/reagent (LR)

$8\,\text{sl. cheese} \times \frac{1\,gc}{1\,\text{sl. cheese}} = 8\,gc$

Excess reactant (XS)

Let's say we only end up w/ (bc 1 burned + threw away) $\boxed{4 \text{ grilled cheeses!}}$

"actual yield"

$$\%\,\text{yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100 = \frac{4}{5} \times 100 = 80\%$$