9/18/2019 (More) fun w/ moles!

NH_3 (ammonia)

$1 \times N = 1 \times 14.01$

$3 \times H = 3 \times 1.008$

17.03

1 molecule NH_3 = 17.03u NH_3

1 mol NH_3 = 17.03g NH_3

6.022×10^{23} molecules NH_3 = 17.03g NH_3

Molar mass

17.03 g/mol

Q: What mass do 2.5×10^{22} molecules of NH_3 weigh?

$$2.5 \times 10^{22} \text{ molecules } NH_3 \times \frac{17.03 \text{ g } NH_3}{6.022 \times 10^{23} \text{ molecules } NH_3} = 0.71 \text{ g } NH_3$$

Q: How many milligrams of NH_3 are there in a 0.0128mol sample?

mg = 10^{-3} g

$$0.0128 \text{ mol } NH_3 \times \frac{17.03 \text{ g } NH_3}{1 \text{ mol } NH_3} \times \frac{\text{mg}}{10^{-3} \text{ g}} = 218 \text{ mg } NH_3$$

Composition of compounds

- what are the elements?
- what are mass %?

- can use to ID / check purity / ...

ex: Calculate mass % elements in $COCl_2$

$1 \times C = 12.01 \rightsquigarrow \%C = \frac{12.01\ g/mol}{98.91\ g/mol} \times 100 = 12.14\%\ C$ (mass C / molar mass)

$1 \times O = 16.00 \rightsquigarrow \%O = \frac{16.00\ g/mol}{98.91\ g/mol} \times 100 = 16.18\%\ O$

$2 \times Cl = 2 \times 35.45 \rightsquigarrow \%Cl = \frac{70.90\ g/mol}{98.91\ g/mol} \times 100 = 71.68\%\ Cl$

$98.91\ g/mol$ ⊕ 100.00%

Mass % ⇝ Formula

mol. form. H_2O_2 ⟶ emp. for. HO

- reverse process!

we actually only get the empirical formula this way!

Map: % elements $\xrightarrow[100\ g]{\text{assume}}$ #g elements ⟶ mol elements

find ratio + write formula!

"Sugar" has 40.00% C
6.71% H
53.28% O

(and a molar mass of 180.2 g/mol)

Assume 100 g

$$40.00\,g\,C \times \frac{1\,mol\,C}{12.01\,g\,C} = 3.331\,mol\,C$$

$$6.71\,g\,H \times \frac{1\,mol\,H}{1.008\,g\,H} = 6.66\,mol\,H$$

$$53.28\,g\,O \times \frac{1\,mol\,O}{16.00\,g\,O} = 3.330\,mol\,O$$

$\div 3.330\,mol$

1.000 C

2.00 H

1.000 'O'

empirical formula: CH_2O ~ emp. molar mass

$1 \times C = 12.01$

$2 \times H = 2 \times 1.008$

$1 \times O = 16.00$

$30.02\,g/mol$

$$\frac{\text{molar mass}}{\text{emp. molar mass}} = n = \frac{180.2\,g/mol}{30.02\,g/mol} = 6.003$$

≈ 6

molecular formula $= (CH_2O)_6 = C_6H_{12}O_6$

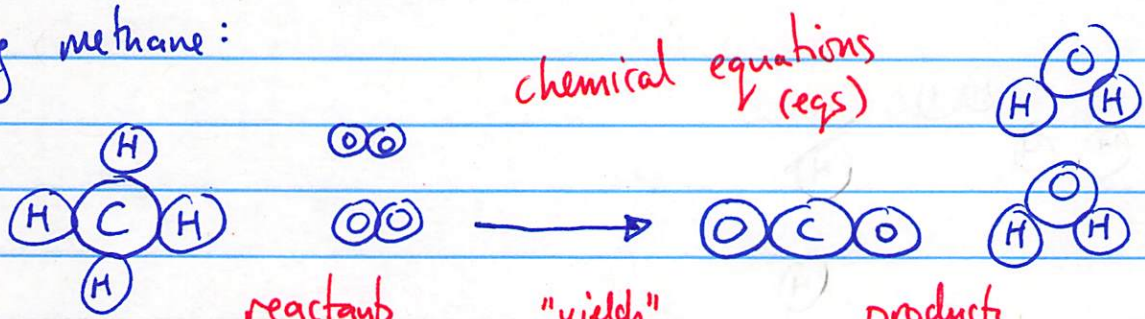
~~ end of exam 1 material ~~

Chapter 4 Chemical reactions (rxns) + chemical quantities.

"Stoichiometry"

burning methane:

chemical equations (eqs)



reactants "yields" products

$$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$$

2 ← coefficient

C:	1	C:	1
H:	4	H:	~~2~~ 4
O:	~~2~~ 4	O:	~~3~~ 4

Balanced!